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J. O. Snyder

U. S. DEPARTMENT OF AGRICULTURE

DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 1

[Actual date of publication, October 25, 1889]

Revision of the North American Pocket Mice

By Dr. C. Hart Merriam

WASHINGTON
GOVERNMENT PRINTING OFFICE
1889

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U. S. DEPARTMENT OF AGRICULTURE,
July 3, 1889.

SIR: I have the honor to transmit herewith the first of a series of faunal papers to be published, under your direction, in the form of a serial entitled NORTH AMERICAN FAUNA. The present communication consists of a revision of the North American Pocket Mice (including descriptions of twelve new species and three new subspecies), and is based largely upon material collected in Dakota, Nebraska, Utah, and Arizona by Mr. Vernon Bailey, an energetic and enthusiastic naturalist now employed as a field agent of the Division.

Respectfully,

C. HART MERRIAM,
Chief of Division of
Ornithology and Mammalogy.

Hon. J. M. RUSK,
Secretary of Agriculture.

ANNOUNCEMENT.

The Division of Ornithology and Mammalogy is engaged in mapping the geographical distribution of birds and mammals, in addition to the study of their economic relations. The purpose of this work is to ascertain the boundaries of the natural faunal areas of North America. The original information on which the maps are based is collected mainly by special field agents employed by the Division; a smaller portion is contributed by voluntary observers. In the progress of the work many new facts are obtained which ought to be put on record for the benefit of other workers in this department of science. It is not unusual to find new species in the collections made by the field agents of the Division, and such species must be named and assigned their proper systematic postion before they can be discussed intelligently.

It is evident that the results of the investigations of the Division are of importance to two distinct classes of readers—farmers and naturalists. It is deemed desirable, therefore, to publish such of the results as are of use mainly to those engaged in scientific research separately from those of a more purely economic character. The publication of the economic material being already provided for (and appearing as bulletins and reports), it has been decided to publish a series of faunal papers, under the title NORTH AMERICAN FAUNA. This publication will contain, in addition to the faunal papers proper, such technical matter as results from the study of the material collected or as may be necessary to an intelligent understanding of the reports which follow.

No attempt will be made to issue the separate numbers at regular intervals, but each number will bear date of actual publication. The present is the first of the series.

No. 1. NORTH AMERICAN FAUNA. October, 1889.

PRELIMINARY REVISION OF THE NORTH AMERICAN POCKET MICE

(Genera PEROGNATHUS ET CRICETODIPUS auct.)

WITH DESCRIPTIONS OF NEW SPECIES AND SUBSPECIES AND A KEY TO THE KNOWN FORMS.

By Dr. C. HART MERRIAM.

INTRODUCTORY REMARKS.

The present contribution toward a revision of the North American Pocket Mice is the outgrowth of a recent attempt to identify a large number of specimens for the purpose of mapping their geographical distribution. The results were wholly unexpected. Only six species were previously recognized. This number is here increased to eighteen; three subspecies also are described, and several well known names are shifted to forms other than those to which they have been heretofore commonly applied. The material at hand is far more extensive[*] and of better quality than that accessible to any previous writer; at the same time many large areas in the West still remain unrepresented in collections.

The present revision of the group is by no means exhaustive—it is intended merely as a foundation for future study. Several problems in synonymy remain to be worked out in the light of material yet to be collected, and additional species remain to be discovered. The region between the Rocky Mountains and the Pacific coast has not been so thoroughly explored as to be barren of new forms; and Mexico, if I may be allowed the prediction, will furnish a number of species now unknown, some of which will shed much light on the affinities of the group and the interrelations of its principal subdivisions.

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[*] The present study is based on about 170 specimens, of which 120 are in my own collection and about 50 in the U. S. National Museum.

HISTORY AND NOMENCLATURE.

Maximilian, Prince of Wied, was first to discover and describe a pocket mouse from North America. In 1839 he published an excellent description of a species collected by himself on the Upper Missouri River, near the mouth of the Yellowstone. He named it *Perognathus fasciatus*—both genus and species being new.[*]

In 1848 Peale described a second genus and species, from Oregon, under the name *Cricetodipus parvus*.[†]

In 1852 Woodhouse described a pocket mouse from San Francisco Mountain, Arizona, naming it *Perognathus penicillatus*.[‡]

In 1855 Baird added another species, *Perognathus flavus*, basing his description on a specimen from El Paso,[§] Texas (but afterwards confusing with it specimens from widely remote localities).

In 1857 Baird described two more species, *P. hispidus*, from northern Mexico, and *P. monticola*, from western Montana.[‖]

In 1868 Gray attempted, though with ill success, to describe two additional species, which he named *Abromys lordi* (gen. et sp. nov.), from British Columbia; and *Perognathus bicolor*, from Honduras.[¶] The former has not been since collected; the latter, as shown by Alston, "is neither a *Perognathus* nor a native of the subregion" (Central America), but is a *Heteromys*, and came from Venezuela. (Ann. and Mag. Nat. Hist., 5th series, VI, 1880, 118, 119.)

Excluding "*P. bicolor*," then, as not belonging to the group at all, the seven species already mentioned are all that have been formally described.

In 1875 Coues provisionally proposed two additional names (*mollipilosus* and *longimembris*),[**] suggesting their adoption in case the animals to which they were applied should prove different from the species under whose names they were placed (*P. monticola* and *parvus*, respectively); thus making a total of nine specific names proposed up to the present time.

In 1857 Baird separated the pocket mice into two sections or subgenera, *Perognathus* and *Cricetodipus*. He characterized *Perognathus* as the larger of the two, with larger ears and a distinct lobe to the antitragus, and with the soles entirely naked; *Cricetodipus* as smaller, with smaller ears, without any lobe to the antitragus, and with the posterior portion of the sole hairy.[††] He assigned no cranial characters to either of these subgenera.

---

[*] Nova Acta Acad. Caes. Leop. Carol., Nat. Cur., XIX, 1839, 368–374, pl. XXXIV.

[†] Rept. Mam. and Ornith., U. S. Expl. Expd., Wilkes, VIII, 1848, 52–54.

[‡] Proc. Acad. Nat. Sci. Phila., 1852, 200.

[§] Proc. Acad. Nat. Sci. Phila., 1855, 332.

[‖] Mammals N. Am., 1857, 421–423.

[¶] Proc. Zool. Soc. Lond., 1868, 202.

[**] Proc. Acad. Nat. Sci. Phila., 1875, 296, 305.

[††] This was done on the assumption that Peale's *Cricetodipus parvus* was the same as the small animal from southern California, here called P. longimembris, which see.

In 1868 J. E. Gray named a genus *Abromys*, from an animal collected in British Columbia by Lord. The only character mentioned by Gray as distinguishing his genus *Abromys* from the genus *Perognathus* is the character of the fur, which he stated to be *soft* in *Abromys* and harsh or hispid in *Perognathus*.

In 1875 Coues raised *Cricetodipus* to full generic rank and pointed out differential cranial characters by which it might be readily separated from *Perognathus*, to which latter genus he referred *Abromys* as a synonym. With characteristic sagacity he suspected that the small species without lobed antitragus might not belong to Peale's genus *Cricetodipus* at all, and therefore provisionally suggested the generic and specific name *Otognosis longimembris* for the Fort Tejon animal, which he described under the head of *Cricetodipus parvus*. This was done on the supposition that the generic name *Perognathus* Max. Wied belonged to the largest species, with lobed antitragus, while in reality the contrary is true, as will be shown directly. *Otognosis* Coues, therefore, becomes a synonym, pure and simple, of *Perognathus*.

Having received a number of specimens of so-called *Cricetodipus flavus* from the region of the Upper Missouri, near the mouth of the Yellowstone, some of them taken within a few miles of the very spot where Maximilian procured his type of *Perognathus fasciatus*, and being unable to secure any reliable record of the occurrence of *Perognathus fasciatus* of Baird[*] and subsequent authors further north than Nebraska, I turned to Maximilian's original description, which is very full and exact, and is accompanied by a colored plate of the animal, natural size, and by figures of the skull and teeth and tables of measurements. It allows no room whatever for difference of opinion as to what his animal really is—it is the *Cricetodipus flavus* (in part) of recent authors, my own specimens from the Upper Missouri region agreeing in the minutest detail with his careful description. This discovery unfortunately renders necessary a total change in the nomenclature of the group. *Cricetodipus* of Baird and Coues becomes a synonym, pure and

---

But in reality *C. parvus* of Peale was a very different animal. His description was based on a single specimen, which must have been very young, as may be seen from the following: (1) Both the Latin diagnosis of the genus and the English description which follows begin with the statement that the head and body were "nearly equal in size," and further on he speaks of "its singularly large head, which equals its body in bulk." (2) The molars are said to have "six rounded tubercles on each." (3) The dental formula is given as follows: "Incisors, $\frac{2}{2}$; canine, $\frac{0\,0}{0\,0}$; molars, $\frac{3}{3}\,\frac{3}{3} = 16$" (and later on in the same description he states that he found "rudiments of a fourth molar tooth in each side of the lower jaw, which would eventually have replaced the front ones, already much worn"). (4) "Lips large, tumid;" which would indicate a sucking young; and (5) the relative proportions of head, body, and feet. The most important measurements, reduced to millimeters, are: Head and body, 48; head from nose to occiput, 23; tail, 58; hind foot, 20.5; metatarsus, 13.

It is perfectly evident from the above that Peale's *Cricetodipus parvus* could not have been one of the smaller species *at all*, but must have been a very young individual *of one of the larger species*, possibly the *Perognathus mollipilosus* of Coues, simple, of *Perognathus*, and the large animal from the plains, called by these authors *Perognathus fasciatus*, is left without a name. I have named it, therefore, *Perognathus paradoxus*.*

During the half century since the publication of Maximilian's description of *Perognathus fasciatus* the species has never been known by its right name. Baird, in 1857, placed it in his subgenus *Cricetodipus* (under the specific name *flavus*). Twenty years later (in 1877) he was followed by Coues, who raised *Cricetodipus* to full generic rank. It is rare, indeed, that a species is thus separated further and further from itself, until it comes to be placed in another genus from that originally framed for its reception.

The aim of the present paper is to establish certain types, and to correct certain errors of nomenclature and synonymy. Hence the descriptions have been based principally on type specimens;† and no attempt has been made to determine the limits of sexual and individual variation, or to discuss other interesting questions which will be treated fully in a subsequent communication.

CLASSIFICATION AND KEY TO SPECIES.

The twenty-one species and subspecies of *Perognathus* here described may be arranged in two principal divisions or subgenera according to their natural affinities. Unfortunately, no dependence can be placed upon external characters, such as size, the presence or absence of a lobed antitragus, the hairiness of the sole, or the possession of a crested penicillate tail, none of these peculiarities being exclusively associated with the members of either subgenus, although heretofore they have been credited with even generic significance. The classification here proposed is based solely on cranial characters. The teeth furnish excellent specific characters, but none of subgeneric value.

SUBGENERA.

Perognathus (proper).

Mastoids largely developed, projecting behind plane of occiput; interparieta, shield-shaped or pentagonal; mastoid side of parietal longest; audital bullæ meeting or nearly meeting anteriorly below basisphenoid.

---

* Professor Baird had but few specimens before him when he wrote his great work on the Mammals of North America, in 1857. It is not strange, therefore, that he fell into one or two errors of identification, particularly in view of the enforced haste in which his manuscript was prepared. His most serious error, and one in which he has been blindly followed by subsequent writers, lay in referring the largest species of the group (*P. paradoxus* of the present paper) to Maximilian's *Perognathus fasciatus*. He noticed the great discrepancy in size, but thought it due to age.

† Of the twenty-one species and subspecies herein formally defined, no less than nineteen have been described from the actual types, twelve of which are in my own collection and seven in the United States National Museum. Of the remaining two, one (*P. fasciatus*), has been described from a duplicate type (*i. e.*, a specimen from the original type locality); the other (*P. flavus*) from a specimen taken about 400 miles from the type locality, Baird's type having been lost. This is the only one concerning which there remains any doubt.

Chætodipus.*

Mastoids moderately developed, not projecting behind plane of occiput; interparietal broadly pentagonal, or strap-shaped; mastoid side of parietal not longest; audital bullæ separated anteriorly by full width or nearly full width of basisphenoid.

The species comprising the subgenus *Perognathus*, excepting *P. formosus* alone, constitute a very natural and compact group. *P. formosus* agrees with the others in cranial characters, but differs from them widely in external peculiarities.

The subgenus may be conveniently divided into two minor groups or sections as follows:

1. **Tail vertebræ ½ longer than head and body; tail heavily crested; ears very long; soles completely naked; pelage coarse.................... *Formosus* group.**
2. **Tail at most only slightly longer than head and body; never crested; ears short or moderate; soles more or less hairy; pelage fine.............. *Fasciatus* group.**

The species comprising the subgenus *Chætodipus* naturally fall into four minor groups or sections, which may be characterized as follows:

A. OCCIPUT TRUNCATED POSTERIORLY.

(a) *Hind foot long and narrow:*

1. Tail always crested-penicillate; interparietal more than twice as broad as long; no supra-orbital bead ....*Penicillatus* group.

2. Tail never crested-penicillate; interparietal less than twice as broad as long; a distinct supra-orbital bead (largest forms known). *Paradoxus* group.

(b) *Hind foot short and broad:*

3. Tail not crested-penicillate.................................*Hispidus* group.

B. OCCIPUT BULGING POSTERIORLY:

4. Tail crested-penicillate; ears very long...............*Californicus* group.

LIST OF SPECIES AND SUBSPECIES HEREIN DESCRIBED.

1. Fasciatus		Subgenus *Perognathus* (proper).
1ᵃ. Fasciatus flavescens		
2. Flavus		
3. Bimaculatus		
4. Longimembris		
5. Apache		
6. Inornatus		
7. Monticola		
8. Olivaceus		
8ᵃ. Olivaceus amœnus		
9. Formosus		
10. Intermedius	*Penicillatus* group.	Subgenus *Chætodipus*.
11. Fallax		
12. Obscurus		
13. Spinatus		
14. Penicillatus		
15. Hispidus, ***Hispidus* group**		
16. Paradoxus	*Paradoxus* group..	
16ᵃ. Paradoxus spilotus		
17. Californicus	*Californicus* group.	
18. Armatus		

KEY TO SPECIES AND SUBSPECIES OF PEROGNATHUS.

In the preparation of the following key the dichotomous system has been followed because of the manifest advantage it affords in presenting

---

******Chætodipus*, in reference to the stiff hairs of these animals compared with the soft pelage of *Perognathus* proper. The type is *Chætodipus spinatus* sp. nov.**

in alternative couplets the characters employed, and also because it permits the use of antithetical diagnoses throughout.

External characters have been selected whenever feasible, in order to increase the usefulness of the key.

For greater convenience, subspecies have been treated as species, both in the key and in the tables which follow:

Mastoids projecting behind plane of occiput; mastoid side of parietal longest (subgenus *Perognathus*).
a^1 *Tail crested-penicillate; pelage coarse.*
Antitragus lobed; hind foot 26; tail vertebræ ¼ longer than head and body .... *formosus.*
a^2 *Tail not crested-penicillate; pelage fine or soft.*
b^1 *Antitragus* LOBED; *size rather large* (tail vertebræ longer than head and body).
c^1 Fur of belly plumbeous at base.
Hind foot about 24.5 .... *amœnus.*
Hind foot about 21 .... *monticola.*
c^2 Fur of belly white to roots of hair .... *olivaceus.*
b^2 *Antitragus* NOT *lobed; size medium or small.*
d^1 Tail vertebræ longer than head and body.
Audital bullæ meeting in symphysis anteriorly .... *inornatus.*
Audital bullæ not meeting anteriorly .... *longimembris.*
d^2 Tail vertebræ not longer than head and body.
e^1 Tail vertebræ nearly as long as head and body.
Lower premolar about half as large as last lower molar ...... *apache.*
e^2 Tail considerably shorter than head and body.
f^1 Tail vertebræ about 60.
Upper parts olive-green .... *fasciatus.*
Upper part yellowish-brown .... *flavescens.*
f^2 Tail vertebræ about 40.
Hind foot 15; lower premolar longer than broad .... *flavus.*
Hind foot 17; lower premolar broader than long .... *bimaculatus.*

Mastoids not projecting behind plane of occiput; mastoid side of parietal not longest (subgenus *Chætodipus*).
OCCIPUT TRUNCATED POSTERIORLY.
b^1 *Hind foot long and narrow.*
c^1 *Tail* crested-penicillate; no supra-orbital bead (*Penicillatus* group).
d^1 *Spines or bristles on rump.*
e^1 Interparietal strap-shaped; rump spines small.
Tail very long (vertebræ 106); pelage coarse .... *intermedius.*
Tail shorter (vertebræ 92); pelage finer .... *obscurus.*
e^2 Interparietal broadly pentagonal; rump spines large.
Hind foot 24; lower premolar larger than last molar .... *fallax.*
Hind foot 21; lower premolar smaller than last molar ...... *spinatus.*
d^2 *No spines or bristles on rump.*
Hind foot about 25 .... *penicillatus.*
c^2 *Tail* not crested-penicillate; a distinct supra-orbital bead (*Paradoxus* group).
Hind foot 26; ear without distinct spot .... *paradoxus.*
Hind foot 23; ear with distinct dark spot .... *spilotus.*
b^2 *Hind foot short and broad.*
Tail not crested-penicillate (*Hispidus* group).
Hind foot 21.5; lower premolar larger than last molar ...... *hispidus.*
a^2 OCCIPUT BULGING POSTERIORLY.
Tail crested-penicillate; ears very long (*Californicus* group).
White spines confined to rump .... *californicus.*
White spines extending forward on flanks .... *armatus.*

ARRANGEMENT OF SPECIES AND SUBSPECIES BY HAIRINESS OF SOLES.

Sole of hind foot	**Entirely naked**	formosus. fallax. intermedius. obscurus spinatus. penicillatus. californicus. armatus. paradoxus. spilatus. hispidus.
	Posterior ¼ hairy	fasciatus. flavescens. flavus. apache.
	Posterior ⅓ hairy	inornatus. longimembris.
	Posterior ½ hairy	olivaceus. amœnus.

ARRANGEMENT OF SPECIES AND SUBSPECIES BY RELATIVE SIZE AND SHAPE OF LOWER PREMOLAR.

1. SIZE OF LOWER PREMOLAR COMPARED WITH LAST MOLAR.

Larger.	*Smaller.*	*About equal.*
Californicus.	Apache.	Paradoxus.
Armatus.	Monticola.	Spilotus.
Hispidus.	Olivaceus.	Inornatus.
Intermedius.	Amœnus.	Fasciatus.
Fallax.	Bimaculatus.	
Obscurus.	Flavescens.	
Penicillatus.	Spinatus.	
Formosus.		
Flavus.		
Longimembris.		

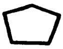
2. RELATIVE PROPORTIONS OF CROWN OF LOWER PREMOLAR.

(a.) *Noticeably longer than broad.*	(b.) *About as broad as long.*		(c.) *Broader than long.*
Californicus.	Paradoxus.	Inornatus.	Apache.
Armatus.	Spilotus.	Olivaceus.	Bimaculatus.
Flavus.	Hispidus.	Amœnus.	Penicillatus.
Fallax.	Intermedius.	Monticola.	Fasciatus.
	Formosus.		Obscurus.
	Flavescens.	Longimembris.	

3. RELATIVE SHAPE OF CROWN OF LOWER PREMOLAR.

(1.) *Narrowest anteriorly.*	(2.) *Narrowest externally.*	(3.) *Sub-triangular.*
Paradoxus.	Apache.	Apache.
Spilotus.	Inornatus.	Fasciatus.
Californicus.	Olivaceus.	Spinatus.
Intermedius.	Amœnus.	
Obscurus.	Fasciatus.	
Fallax.	Formosus.	
Penicillatus.	Spinatus.	
Formosus.		
Monticola.		
Flavescens.		

ARRANGEMENT OF SPECIES AND SUBSPECIES BY SHAPE OF INTERPARIETAL

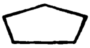


Shield-shaped or squarish-pentagonal **(ratio of length to breadth above**

Inornatus.
Apache.
Longimembris.
Bimaculatus (?).
Fasciatus.

Flavus (anterior angles rounded).
Olivaceus.
Amœnus.
Monticola.

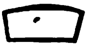
Formosus (posterio gles rounded).
Flavescens.



Broadly pentagonal **(ratio of length to breadth below 60).**

Penicillatus (posterior angles rounded).
Fallax.
Spinatus.

Paradoxus.
Spilotus } posterior angles rounded;
Hispidus } strongly divergent ante
Californicus (convex posteriorly).



Strap-shaped **(ratio of length to breadth 38.2 to 46.6).**

Obscurus.
Intermedius.

Arrangement of species and subspecies by parietal proportions.

[By longest side.]

Mastoid side longest.	Median and frontal sub-equal.	Frontal and posterior subequal (median shorter).	Frontal, posterior, and median sub-equal.
Apache. Inornatus. Longimembris. Flavus. Bimaculatus. Fasciatus. Flavescens. Formosus. Olivaceus. Amœnus. Monticola.	Paradoxus. Spilotus. ? Hispidus. Fallax. Intermedius. Obscurus.	Californicus. Penicillatus.	Spinatus. Armatus.

*Measurements and ratios of skulls of Perognathus.**

	Fasciatus. 4445 ♂	Flavescens. 5027 ♂	Apache. 4984 ♂	Inornatus. 13394 ♂	Longimembris. 3572 ♂	Flavus. 5047 ♂	Olivaceus. 5623 ♂	Amœnus. 5795 ♂	Monticola. 1585 ♀	Formosus. 5908 ♂	Intermedius. 5309 ♂	Fallax. 22684 ♂	Obscurus. 2848 ♀	Spinatus. 6137 ♂	Penicillatus. 6206 ♂	Paradoxus. 1544 ♀	Spilotus. 22096 ♀	Californicus. 5827 ♀	Hispidus. 1666 ?
Basilar length (occipital condyle to incisor)	19	17.5	19.3	......	16.7	15.8	20.6	21	......	21.1	19	20.8	19.7	18.8	21.1	26.6	25.2	20.5	......
Basilar length of Hensel (inferior lip of foramen magnum to incisor)	18	15.4	17.5	......	15	14	18.5	19	......	19.2	16.6	18.7	17.4	16.5	19.1	28.7	23	18.1	......
Occipito-nasal length (greatest length of skull)	23.4	22.3	24.3	23.2	21.4	19.7	27	26.5	24.5	27.5	24.4	26.7	25.4	23.7	26.4	32	81	26.7	†27.5
Greatest mastoid breadth	12.3	12	12.3	12.9	11.8	11	13.4	13.8	13	14.6	13.5	13.8	13	12.2	13.2	15.7	14.5	13.4	14.5
Intermastoid breadth (at narrowest point)	4.1	5.3	3.8	3.4	3.6	3.2	5.4	5.7	5.2	6	8	8.4	8	8	8.6	9	8.6	8.7	8
Greatest length of interparietal	3	3.2	3	2.8	3.2	2.5	3.6	3.5	3.4	4	3	3.7	3.4	3.5	3.5	4.5	4.2	4.3	3.8
Greatest breadth of interparietal	4.5	5.2	3.8	3.3	3.7	3.2	5.1	5.3	5	5.8	7.8	8.1	7.3	7.3	7.5	8	7.3	8.5	7
Ratio of mastoid breadth to basilar length (condylar)	64.7	68.5	63.7	......	70.6	69.6	65	65.7	......	69.1	71	66.3	65.9	64.8	62.5	59	57.5	65.3	......
Intermastoid breadth to basilar length (condylar)	21.5	30.2	19.6	......	21.5	20.2	26.2	27.1	......	28.4	42.1	40.3	40.6	42.5	40.7	33.8	34.1	42.4	......
Mastoid breadth to basilar length of Hensel	68.3	77.9	70.2	......	78.6	78.5	72.4	72.6	......	76	81.3	73.7	74.7	73.9	69.1	66.2	68	74	......
Intermastoid breadth to basilar length of Hensel	22.7	34.4	21.7	......	24	22.8	29.1	30	......	31.2	47.8	44.9	45.9	48.4	45	37.9	37.3	48	......
Mastoid breadth to occipito-nasal length	52.5	53.8	50.6	55.6	55.1	55.8	49.6	52	53	53	55.3	51.6	51.1	51.4	50	49	46.7	50.1	†52.7
Length to breadth of interparietal	66.6	61.5	78.9	84.8	86.4	78.1	70.5	66	68	69	38.2	45.6	46.6	47.9	46.6	56.3	57.5	50.5	54.2

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* This table contains measurements and ratios of nineteen of the twenty-one species and subspecies described in this paper. The skulls of the two remaining species (*bimaculatus* and *armatus*) are too much broken to admit of measurement.

†Approximate; skull broken.

PEROGNATHUS FASCIATUS Maximilian.

Perognathus fasciatus Max. Wied, Nova Acta Acad. Cæs. Leop. Carol., XIX, I, 1839, 369–373, pl. XXXIV (col.). *Type* from the Upper Missouri near its junction with the Yellowstone.—Max. Wied, Reise in das innere Nord Amerika, I, 1839, 449–450.

Perognathus flavus Baird, Mammals of North America, 1857, 423–425 (in part only).

Duplicate type $\frac{3886}{4448}$ ♂. From near junction of Yellowstone and Missouri Rivers, Montana, October 6, 1887. Vernon Bailey.

Measurements.—Total length, 135; tail vertebræ, 60 (taken in flesh by collector). Hind foot, 17.5; ear from crown, 4.5 (measured from dry skin).

General characters.—Size small (intermediate between *penicillatus* and *longimembris*); ears small, well haired on both sides, particularly on the inflexed upper portion and on the base below; no antitragal lobe; tail nearly as long as head and body, not crested or penicillate; posterior half of soles haired; pelage soft.

Color.—Above, between olive green and olive-gray, faintly suffused with pale fulvous, and finely lined with blackish; a light fulvous lateral stripe*; under parts, including fore legs and feet, white to roots of hairs. Tail not bicolor, but slightly paler below than above. Ears with a light yellowish patch on inflexed upper portion, another on lower margin; a larger patch of same color behind each ear.

Cranial and dental characters.—Skull rather small, moderately arched; mastoids largely developed and projecting slightly behind plane of occiput (ratio of mastoid breadth to basilar length of Hensel, 68.3; of intermastoid breadth, 22.7); audital bullæ separated by less than breadth of basisphenoid; interparietal pentagonal, considerably broader than long (ratio of length to breadth 66.6); nasals not extending quite so far posteriorly as nasal branch of premaxillaries; mastoid border of parietal longest; coronoid process of mandible rather long. Upper premolar hardly as broad as first molar; second and third molars successively narrower. Lower premolar about the size of last molar, its crown broader than long,† much narrower externally than internally, and anteriorly than posteriorly; first lower molar conspicuously the largest tooth; second and third successively smaller; deciduous lower premolar nearly twice as long as broad, as usual in the genus.

General remarks.—*Perognathus fasciatus* is remarkable among mammals for the olive-green color which pervades its upper parts. A trace of the same tint occurs in its congeners *P. olivaceus* and *P. olivaceus amœnus*, but it is only a trace. In size it ranks among the smaller members of the genus, being little larger than *longimembris*.

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* Throughout this paper the term *lateral stripe* is applied to the tawny band which usually separates the color of the upper parts from the white of the under parts. It must not be supposed to imply the existence of a real stripe *within* the color of the upper parts, such as is present in many of the ground squirrels.

† In the genus *Perognathus* the deciduous lower premolar is a long time in falling out, and in the case of young skulls care must be taken not to mistake it for the permanent tooth. It is very much longer than broad, and has five well-developed cusps: an anterior, a middle pair, and a posterior pair (see plate IV, fig. 1).

Just fifty years ago (in 1839) this beautiful species, the type of the genus *Perognathus*, was accurately described and figured by Prince Maximilian from specimens collected by himself near the junction of the Yellowstone with the Missouri. From that time till the present it has never been recognized by its right name, but has been confounded with *Perognathus flavus*, a very different animal. The origin of this confusion has been already explained in the introductory portion of the present paper.

PEROGNATHUS FASCIATUS FLAVESCENS subsp. nov.

Perognathus flavus Baird, Mamm. N. Am., 1857, 423–425 (in part only).

Type $\frac{4207}{5027}$ ♂ ad. From Kennedy, Nebraska, June 11, 1888. Vernon Bailey.

Measurements.—Total length, 136; tail vertebræ, 63 (taken in flesh by collector). Hind foot, 17; ear from crown, 4 (measured from dry skin).

General characters.—Size of *P. fasciatus*, with ears and tail as in that species; pelage coarser.

Color.—Above, pale yellowish-brown, lined with blackish, without trace of the olive-green of *fasciatus;* sides with a pale fulvous lateral stripe; under parts, including fore legs and feet, white to base of hairs; ear with a whitish spot on inflexed upper portion and another on inferior margin. The dark hairs of the back do not reach so far down on the face and sides as in *fasciatus*; on the head they are limited to the triangular space extending from the upper corners of the ears to the sides of the nose, leaving a broad zone of pale fulvous around each eye. The end of the nose is whitish all round. The absence of black hairs from the upper surface of the thighs leaves these parts pale fulvous like the sides.

Cranial and dental characters.—Skull a little smaller than that of *fasciatus*; vault of cranium more highly arched; mastoids not quite so large (ratio of mastoid breadth to basilar length of Hensel, 77.9; of intermastoid breadth, 34.4); interparietal broader (ratio of length to breadth, 61.5), sides much spreading, posterior edge notched; audital bullæ meeting anteriorly; mastoid border of parietal longest; coronoid process of mandible more slender and less spreading. Lower premolar slightly smaller than last molar, its crown squarish with rounded corners; not decidedly narrower externally than internally.

General remarks.—*P. fasciatus flavescens* is a well marked subspecies, easily distinguished from *fasciatus* by coloration, by its broad orbital ring, by the comparative harshness of its pelage, by the shape of the crown of its lower premolar, and by the fact that its audital bullæ meet anteriorly.

PEROGNATHUS FLAVUS Baird.

Perognathus flavus Baird, Proc. Acad. Nat. Sci. Phila., Apr., 1855. 332 (*type* from El Paso, Tex.).—Baird, Mamm. N. Am. 1857. 423–425 (in part only).

No. $\frac{4329}{6049}$ ♂ ad. From Mason, Texas, May 31, 1888. Ira B. Henry.

Measurements.—Total length 95^{mm} (taken in flesh by collector; other measurements from dry skin); tail vertebræ, 40 + (extreme tip gone); hind foot, 15; ear from crown, 4.

General characters.—Size, smallest of the known species; ear relatively large; no antitragal lobe; tail considerably less than head and body—perhaps about equaling body alone—not crested or penicillate; pelage soft; posterior half of sole sparsely haired.

Color.—Above, light fulvous, obscured by black-tipped hairs and clearest on the sides, but no distinct lateral stripe; under parts, including fore legs and feet, white to base of hairs; ears with a white spot on inferior margin; a large, light yellowish-buff patch behind each ear; a broad ring of dull, pale fulvous around each eye.

Cranial and dental characters.—Skull very small, with largely-developed mastoids, which encroach on interparietal and project behind occipital plane (ratio of mastoid breadth to basilar length of Hensel, 78.5; of intermastoid breadth, 22.8); interparietal very small, with anterior angles much rounded (ratio of length to breadth, 78.1); audital bullæ meeting in symphysis below basisphenoid; mastoid border of parietal longest. Lower premolar slightly larger than last molar, its crown longer than broad. First lower molar largest; second and third successively smaller.

General remarks.—Unfortunately, Baird's type can not be found. His original description, which is very brief, applies well to the above specimen from Mason, Texas, except that the tail was longer. Mason is a little more than 400 miles east of El Paso, and is in another faunal area; hence it would not be strange if future collections show the El Paso animal to be different from the one here described.*

PEROGNATHUS BIMACULATUS sp. nov.

Type no. $\frac{8455}{23789}$ ♂ ad. U. S. National Museum. From Fort Whipple, Arizona, May 21, 1865. Dr. Elliott Coues.

Measurements.—Total length, 117^{mm}; head and body, 71 (taken in flesh by collector). Tail vertebræ, 40 (bone left in tail); hind foot, 17; ear from crown, 4 (from dry skin).

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* Following is Baird's original description in full:

"*Perognathus flavus* Baird.—Much smaller than the common house mouse (*Mus musculus*). Tail nearly equal to or less than the body, scarcely differing in color above and below. Hind feet short.

"*Color.*—Above yellowish buff, with dusky tips to some of the hairs; paler and clearer on the sides. Beneath snowy white to the roots of the hairs. Hairs on the back plumbeous only on their basal half. Head and body, 2$\frac{1}{12}$ inches. Tail to end *of vertebræ, 2 inches.* Hind foot from heel, 7¼ inches [manifest error for *lines*].

"*Collected at El Paso* by J. H. Clark." (Proc. Acad. Nat. Sci. Phila., vol. VII, *1855, 332.)*

General characters.—Size, small, about equal to *P. longimembris*; tail short, hardly equaling body without head; ear relatively large; no antitragal lobe; pelage soft; sole haired on posterior half.

Color.—Similar to that of *P. flavus* but darker, with top of nose much darker, and yellowish post-auricular spot much larger and more conspicuous.

Cranial and dental characters.—Nothing remains of the skull but a few fragments. The mastoids, audital bullæ, and interparietal are altogether wanting, so that it is impossible to ascertain a single cranial character. The lower jaw, however, is in fair condition and the teeth remain in situ. The lower premolar is noticeably smaller than the last molar and its crown is broader than long.

General remarks.—*P. bimaculatus* may be distinguished from *P. flavus* by its larger size, longer hind foot (17 instead of 15), and the small size of the lower premolar.

PEROGNATHUS LONGIMEMBRIS (Coues).

?*Perognathus parvus* Baird [*not* Peale], Mammals N. Am., 1857, 425–426 (from Tulare County, Cal.).

Cricetodipus parvus Coues, Proc. Acad. Nat. Sci. Phila., 1875, 303–305.

Otognosis longimembris Coues [provisional name], Proc. Acad. Nat. Sci. Phila., 1875, 305.

Type no. 9856, ♀, U. S. National Museum. From Fort Tejon, Cal. J. Xantus.

Measurements.—Head and body, 51^{mm} (from Coues; other measurements made by myself from the alcoholic specimen); tail vertebræ, 58; pencil, 8; hind foot, 17.5; ear, 3.5.

General remarks.—Coues states: "As well as can be judged from the insufficient material before me, this species does not differ materially in color from *P. flavus*; and in fact the only diagnostic characters at present appreciable are the greater length of the hind feet and tail." (Proc. Acad. Nat. Sci. Phila., 1875, 304.)

Fortunately, I possess a fine series of specimens from San Bernardino, Cal., which place is only about 100 miles from Fort Tejon, the type locality of *O. longimembris*. I take pleasure in adding, therefore, the following description of an adult male:

No. [illegible] ♂ ad. From San Bernardino, Cal., May 6, 1885. F. Stephens.

Measurements.—Head and body, 56; tail vertebræ, 63; hairs, 5.5; (taken in flesh by collector); hind foot, 17.5; ear from crown, 4.5 (measured from dry skin).

General characters.—Size, small; ears rather large, without antitragal lobe; tail vertebræ a little longer than head and body; scantily haired, and with a sparse terminal pencil, not crested; posterior third of soles haired; pelage soft.

Color.—Above, yellowish brown, everywhere finely lined with dusky; sides with a lateral line of the same color, but without the dark hairs; under parts, including fore legs and feet, white; tail concolor, yellowish, becoming dusky toward the tip. There is a yellowish patch behind each ear, and a white spot at the inferior margin of the ear. [Some specimens have also a white spot on the infolded upper margin. Young grayish brown above, tail darker above than below.]

Cranial and dental characters.—Skull small, rather flat; mastoids very much swollen, projecting considerably behind plane of occiput (ratio of mastoid breadth to basilar length of Hensel, 78.6; of intermastoid, 24); interparietal pentagonal, nearly as long as broad (ratio of length to breadth, 86.4); audital bullæ separated by full breadth of basisphenoid; mastoid border of parietal longest. Coronoid process of mandible moderately developed. Lower premolar slightly larger than last molar, its crown squarish, slightly narrower anteriorly than posteriorly, and externally than internally; first molar larger than second; third a little more than half as large as second.

PEROGNATHUS APACHE sp. nov.

Type $\frac{4853}{4934}$ ♂ ad. Apache County, Arizona, May 22, 1888.

Measurements.—Total length (measured in the flesh), 140. Tail, 68; hind foot, 18.5; ear from crown, 4 (measured from dry skin).

General characters.—Size, medium; tail about as long as head and body, or a little shorter, not crested or penicillate; ears small; no antitragal lobe; soles haired to base of toes; whiskers rather short; pelage moderately soft.

Color.—Above, light tawny-ochraceus, finely and sparingly lined with black, which does not hide the ground color; under parts, including fore legs and feet, pure white to base of fur. Tail indistinctly bicolor, yellowish above and whitish beneath. Ears with an indistinct whitish spot on lower margin. On the back the plumbeous basal portion of the fur occupies less than half the length of the hairs.

Cranial and dental characters.—Skull a little larger than that of *P. fasciatus*, nearly flat; mastoids greatly swollen, reaching, perhaps, the maximum of devolopment seen in the genus, and projecting backward behind the plane of the occiput (ratio of mastoid breadth to basilar length of Hensel 70.2; of intermastoid breadth 21.7); interparietal pentagonal, very small, sides scarcely divergent anteriorly (ratio of length to breadth 78.9); audital bullæ meeting in a symphysis below the basisphenoid; nasals ending posteriorly almost on a line with nasal branch of premaxillaries; mastoid border of parietal longest; coronoid process of mandible rather small. Crown of upper premolar narrower than first molar; lower premolar very small, scarcely half as large as last molar, its crown broader than long, subtriangular.

General remarks.—*P. apache* is the *yellowest* species thus far discovered. In size it is a little larger than *P. fasciatus*. In the great development of the mastoids and consequent smallness of the interparietal it closely approaches *P. inornatus*.

PEROGNATHUS INORNATUS sp. nov.

gnathus parvus Baird, Mamm. N. Am., 1857, 425–426.

rpe No. $\frac{13334}{23790}$ ♂ yg. ad. Fresno, California.

asurements.—(Taken from alcoholic specimen before skinning out) Total length, 137; head and body, 65; tail vertebræ, 71; pen- ; hind foot, 18.5; ear from crown, 4.

eral characters.—Size, medium, about equaling *P. apache*, which atly resembles; tail a little longer than head and body, not crested; ather small; no antitragal lobe; posterior third of soles haired; kers rather short; pelage rather soft.

or.—Owing to long immersion in alcohol it is impossible to be sure original color. Apparently, however, it was a light yellowish- n not unlike that of *P. apache*, but faintly lined with blackish.

nial and dental characters.— Skull similar to that of *P. apache* in nd shape, but even flatter, and narrower interorbitally; mastoids ly swollen and projecting considerably behind plane of occiput of mastoid breadth to occipito-nasal length, 55.6); audital bullæ ng anteriorly in symphysis; interparietal very small, squarish- gonal with sharp angles (ratio of length to breadth, 84.8); nasals g considerably short of nasal branch of premaxillaries; mastoid r of parietal longest. Coronoid process of mandible rather large. r premolar about the size of last molar, its crown squarish, slightly wer externally than internally.

eral remarks.—In size, proportions, and (?) color *P. inornatus* closely bles *P. apache*. Its skull also bears a striking resemblance to that che, but is narrower interorbitally and has shorter and more slender s. The lower premolar, however, is very different, being about ze of the last molar instead of only half as large, and its crown is ish instead of subtriangular as in *apache*. From *P. longimembris* asily distinguished by its much larger size.

ry probably this is the species described by Baird as *P. parvus*. specimen was very young and was mounted. Its mutilated and l remains afford no positive characters, but the length of its hind [18^{mm}, as given by Baird], and the circumstance that it came from s River, Tulare County, Cal., a locality only a few miles distant Fresno, suggest the probability of its identity with the present es.

PEROGNATHUS OLIVACEUS sp. nov.

rpe $\frac{4873}{5623}$ ♂. Kelton, Utah, October 24, 1888. Vernon Bailey.

asurements.—Total length to end of vertebræ, 184; tail to end of bræ 101; pencil, 9 (taken in flesh by collector); hind foot, 23; ear crown, 5 (measured from the dry skin).

eral characters.—*Size rather large*; ears medium, with antitragal *large, about as high as broad*; tail slightly penicillate, not noticeably crested, its vertebræ longer than head and body; soles haired on posterior fourth; pelage soft and silky.

Color.—Above, yellowish-brown, finely mixed with black, and tinged with olive, though not so distinctly as in *P. fasciatus;* below, pure white to roots of hair. Tail bicolor: above, proximal half like the back, distal half becoming sooty-brown; below, white. There is a distinct white spot on the inferior margin of the ear which reaches up to the base of the antitragal lobe.

Cranial and dental characters.—Skull rather large, moderately arched; mastoids greatly developed (ratio of mastoid breadth to basilar length of Hensel 72.4; of intermastoid breadth 29.1); interparietal rounded shield-shaped (ratio of length to breadth 70.5); nasals not reaching quite so far back as nasal branches of premaxillaries; audital bullæ separated anteriorly by less than full breadth of basisphenoid; mastoid border of parietal longest. Coronoid process of mandible moderately long. Lower premolar slightly smaller than last molar; its crown squarish, slightly narrower externally than internally; first and second molars subequal.

General remarks.—*P. olivaceus* looks like an overgrown *P. fasciatus*, It has the same soft, silky fur, the same white spot below the ear, and, though to a less degree, the same olive tinge which is so unusual among mammals. But it is much larger than *fasciatus*, has a penicillate tail, and a different skull.

PEROGNATHUS OLIVACEUS AMŒNUS subsp. nov.

Type No. $\frac{4193}{5793}$ ♂. Nephi, Utah, November 23, 1888. Vernon Bailey.

Measurements.—Total length, 178; tail vertebræ, 93 (taken in the flesh by collector); pencil, 9; hind foot, 24.5; ears from crown, 4 (measured from the dry skin).

General characters.—Size rather large; ears small, with antitragal lobe large, a little higher than broad; tail penicillate, not crested, its vertebræ longer than head and body; soles haired on posterior fourth; pelage soft and silky.

Color.—Above, yellowish-brown, finely mixed with black, and faintly tinged with olive; sides pale salmon, fading gradually into the white of the under parts, which is suffused with the same color; hairs of belly plumbeous at base. Tail indistinctly bicolor: above, proximal half colored like back, but paler; distal half becoming sooty-brown; below, whitish. There is a small spot of yellowish-white on the inferior margin of the ear.

Cranial and dental characters.—Very similar to *P. olivaceus*, but skull a little broader posteriorly, and interparietal relatively broader (ratio of length to breadth 66).

General remarks.—*P. olivaceus amœnus* differs from *P. olivaceus* in *having smaller ears* with the light spot on inferior margin much less conspicuous; in having the fur of the belly plumbeous at base and suffused with salmon, instead of pure white, and in having the hind foot longer and the tail shorter.

PEROGNATHUS MONTICOLA Baird.

Perognathus monticola Baird, Mammals N. Am., 1857, 422–423. *Type* from (?) St. Mary's Mission, Montana.

Type $\frac{1585}{431}$ ♀ . U. S. National Museum. St. Mary's Mission (?), west of Rocky Mount s.

Measurements.—(From Baird) Head and body 76; tail 78 + (tip broken off); hind foot 21.*

General characters.—Size medium, a little smaller than *P. olivaceus;* ears medium; antitragus lobed; tail not crested-penicillate; its vertebræ slightly longer than head and body; pelage moderately soft.

Color.—(From Baird) Above, mixed cinnamon and dusky; beneath, white; hairs below as well as above, plumbeous at base; a pale cinnamon lateral stripe; outside of fore leg dusky to the wrist; tail bicolor.

Cranial and dental characters.—Skull a little smaller than that of *P. olivaceus*, a little larger than *fasciatus;* vault of cranium arched about as in *olivaceus*. Mastoids largely developed, projecting slightly behind plane of occiput; audital bullæ united anteriorly by symphysis; interparietal pentagonal, relatively broader than in *formosus*, but not so broad as in *fasciatus* and *flavescens* (ratio of length to breadth 68.0); mastoid border of parietal longest; coronoid process of mandible slightly longer than in *olivaceus*, but not so long as in *fasciatus*. Lower premolar smaller than last molar, its crown a little longer than broad, and narrower anteriorly than posteriorly.

General remarks.—*P. monticola* is a perfectly good species, which has escaped notice since 1853, when the type and only known specimen was collected by Dr. George Suckley. Its skull indicates affinity with *P. olivaceus*. In coloration it *now* resembles *P. penicillatus*, but it is so worn and faded from long exposure to light and dust that little dependence can be placed on its present color. The practice of mounting and exhibiting type specimens can not be too strongly condemned. It is a relic of barbarism which modern museums can not afford to perpetuate.

PEROGNATHUS FORMOSUS sp. nov.

Type No. [illegible] ♂ ad. St. George, Utah, January 2, 1889. Vernon Bailey.

Measurements.—Total length to end of vertebræ, 195; tail vertebræ, 111, pencil 16; hind foot, 26 (taken in flesh by collector); ear from crown, 6 (measured from the dry skin).

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*This is the present measurement of the hind foot in the mounted specimen, and consequently must be a little less than in life. Baird's measurement (.80 inch) is a little too short.

General characters.—Size large; ears very large; antitragal lobe considerably higher than broad; tail vertebræ a fourth longer than head and body; tail penicillate, and crested above on the terminal third; soles entirely naked to end of heels; pelage moderately soft, not so fine as in *P. olivaceus*, and not so harsh as in *penicillatus*.

Color.—Above, grizzled yellowish-brown, with an abundant admixture of black-tipped hairs (this color reaching down on the arms to the elbows); below, white to roots of hairs; lateral line, faint and narrow; tail, bicolor: above, proximal third colored like back, then gradually becoming darker until the distal half is dark sooty-brown; below, yellowish-white, except the pencil, which is dark on both sides.

Cranial and dental characters.—Mastoids largely developed (ratio of mastoid breadth to basilar length of Hensel 76; of inter-mastoid breadth 31.2); interparietal pentagonal, with posterior angles rounded, considerably broader than long (ratio of length to breadth 69); audital bullæ meeting anteriorly in a symphysis; mastoid border of parietal longest; mastoid bar of squamosal reduced to a mere spicule, which disappears above the meatus; coronoid process of mandible minute and depressed—not nearly so prominent as in *olivaceus*. Upper premolar broader than first molar; lower premolar larger than last molar, its crown about as broad as long, conspicuously narrower anteriorly than posteriorly, its posterior cusp nearly as broad as second molar; last lower molar smaller than usual in the group.

General remarks.—This elegant species, which I have named *Perognathus formosus*, is the largest of the subgenus *Perognathus*, from all other members of which it differs in the possession of a very long and heavily crested tail, the vertebræ alone measuring one-fourth more than the head and body. Its ears also are very long, about equaling those of *Chætodipus californicus*, and its soles are entirely naked. In fact, from its external characters no one would suspect it to belong to the subgenus *Perognathus* at all. To use a "Couesianism," it has the skull of a *Perognathus* in the skin of a *Chætodipus*.

PEROGNATHUS INTERMEDIUS sp. nov.

Type no. [illegible] ♂ ad. Mud Spring, Arizona, February 26, 1889. Vernon Bailey.

Measurements.—Total length, 183; tail vertebræ, 106; pencil, 18; hind foot, 21 (taken in flesh by collector); ear from crown, 4.5 (from dry skin).

General characters.—Size intermediate between *spinatus* and *penicillatus;* tail vertebræ much longer than head and body; tail crested-penicillate; soles naked; ears thicker and darker than in *penicillatus;* antitragal lobe large; higher than broad; lateral stripe present; soles naked; pelage coarse, with slight tendency to become bristly on rump (bristles about as in *obscurus*).

Color.—Above, drab-gray, faintly suffused with pale fulvous and coarsely lined with blackish; lateral line, pale fulvous; below, including fore legs and feet, white to roots of hairs. Tail, bicolor; sooty-brown above, whitish beneath.

Cranial and dental characters.—Skull intermediate in size between *penicillatus* and *spinatus*, slightly more arched than that of *penicillatus*; mastoids relatively larger than in either *penicillatus* or *spinatus*; audital bullæ separated by a little less than full breadth of basisphenoid; interparietal strap-shaped, much more than twice as broad as long (ratio of length to breadth 38.2), its anterior margin only very slightly convex; nasals ending posteriorly about on a line with nasal branch of premaxillaries; median and frontal borders of parietal subequal. Coronoid process of mandible rather small. Lower premolar a little larger than last molar; its crown about as long as broad; noticeably narrower anteriorly than posteriorly. Owing to the nearly straight anterior margin of the interparietal, the parietals are unusually long in the median line, measuring as much along the sagittal suture as along the frontal border.

General remarks.—In size and coloration *P. intermedius* closely resembles *P. spinatus*, but it has a distinct, though pale, lateral stripe. It has a few small bristles on its rump, but nothing like the long grooved spines of *spinatus*. Its lower premolar is much larger than that of *spinatus*, and squarish instead of subtriangular. It differs from *penicillatus* in size, coloration, and the tendency to develop bristles; also in the greater size of the mastoids, and in other cranial proportions. From *P. obscurus* it may be distinguished by its larger size, longer tail, coarser pelage, and by cranial characters. Perhaps its closest affinities are with *P. fallax*, from San Bernardino, Cal., from which it differs in being smaller, and in the smaller size of its ears, hind feet, and rump bristles, and in the nearly straight anterior edge of the interparietal.

PEROGNATHUS FALLAX sp. nov.

Type $\frac{18852}{24464}$ ♂ ad. U. S. National Museum. From San Bernardino, Cal., April 21, 1887. F. Stephens.

Measurements.—Head and body, 79; tail vertebræ, 104 (taken in flesh by collector); pencil, 15; hind foot, 24; ear from crown, 6 (taken from dry skin).

General characters.—Size large; tail crested-penicillate, its vertebræ much longer than head and body; ears large, thicker than in *penicillatus*; antitragal lobe much higher than broad; soles naked; pelage moderately soft (about as in *penicillatus*), becoming bristly on the rump. The bristles are arranged and colored as in *spinatus*; they are larger than in *obscurus*, but not so large as in *spinatus*.

Color.—Above, dark grizzled yellowish-brown, profusely lined with black; lateral line pale fulvous, covering the upper surface of the fore leg; below, white to base of hairs. Tail bicolor: above, sooty-brown; below, white.

Cranial and dental characters.—Skull large and broad, much arched; mastoids rather small (ratio of mastoid breadth to basilar length of Hensel, 73.7; of intermastoid breadth, 44.9), but slightly larger than in *penicillatus;* interparietal more than twice as broad as long (ratio of length to breadth, 45.6); audital bullæ separated anteriorly by nearly full breadth of basisphenoid; nasals emarginate posteriorly, extending nearly as far back as nasal branch of premaxillaries; frontal border of parietal longest, median and posterior subequal. Coronoid process of mandible very short, not rising to the level of the condyle. Upper tooth row strongly curved, the convexity outward. Lower premolar larger than last molar, its crown slightly longer than broad, and narrower anteriorly than posteriorly.

General remarks.—In size, length of ear, and coloration this species is intermediate between *penicillatus* and *californicus.* It is nearly as dark above as *californicus*, and has the lateral stripe and rump bristles of that species. Its skull, on the other hand, is clearly of the *penicillatus* type. At the same time it is more arched than that of *penicillatus*, and the plane of the occiput is a little fuller posteriorly. The coronoid process of the mandible is very short and low, and the crown of the lower premolar longer than broad, as in *californicus.*

PEROGNATHUS OBSCURUS sp. nov.

Type No. $\frac{2340}{2844}$ ♀ ad. From Camp Apache, Grant County, New Mexico, April 30, 1886. A. W. Anthony.

Measurements.—Total length, 168^{mm} (measured in flesh by collector; other measurements from dry skin); tail vertebræ about 92; pencil, 11; hind foot, 21; ear, from crown, 4.

General characters.—Size rather small, slightly smaller than *spinatus;* tail crested-penicillate, its vertebræ considerably longer than head and body, but relatively shorter than in *penicillatus;* ears large, moderately well haired; antitragal lobe higher than broad; tragus evident; hind feet large and broad; soles naked; whiskers very long, reaching to middle of body; pelage rather soft; hairs of rump very long with tendency to develop bristles.

Color.—Above, drab, suffused with pale fulvous, finely and profusely lined with blackish; a pale fulvous lateral stripe; below, including fore legs and feet, white to base of hairs, suffused with very pale fulvous or salmon.

Cranial and dental characters.—Skull rather large and flat, very broad interorbitally; mastoids small (ratio of mastoid breadth to basilar length of Hensel, 74.7; of intermastoid breadth, 45.9); audital bullæ separated anteriorly by full breadth of basisphenoid; interparietal strap-shaped, more than twice as broad as long (ratio of length to breadth 46.6); nasals extending posteriorly nearly as far as nasal branch of premaxillaries; median and frontal borders of parietal longest and subequal. Coronoid process of mandible small. Lower premolar much larger than last molar, its crown broader than long, and narrower anteriorly than posteriorly.

General remarks.—P. obscurus is one of the few known species besides *spinatus* which show any tendency toward the development of spines in the pelage, but the small bristles on its rump are hardly more than a step in the direction of the large spines of *spinatus.* It differs further from *spinatus* in its smaller size, larger head, broader hind foot, shorter tail, finer pelage; in the presence of a pale fulvous lateral stripe and a suffusion of the same color throughout; in having a larger and flatter skull; in having the audital bullæ separated by full breadth of basisphenoid; in having the lower premolar larger than the last molar and its crown longer than broad.

PEROGNATHUS SPINATUS sp. nov.

Type No. $\frac{5442}{6137}$ ♂ ad. From Lower Colorado River, California, 25 miles below the Needles, March 23, 1889. Vernon Bailey.

Measurements.—Total length, 179; tail vertebræ, 104; pencil, 15; hind foot, 21 (taken in flesh by collector). Ear from crown, 3.5 (measured from dry skin).

General characters.—Size, rather small; tail crested-penicillate, its vertebræ a fourth longer than head and body; ears moderate, scant haired; antitragal lobe large; whiskers long; soles naked; pelage very coarse, becoming spinous on the rump.

Color.—Above, clear drab-gray, grayest on the sides, coarsely lined with blackish; no lateral stripe; under parts, including fore legs and feet, creamy white to roots of hairs. Tail sharply bicolor—above, dusky; below, white to end of vertebræ; pencil dusky all round.

Cranial and dental characters.—Skull of medium size, considerably smaller and more arched than that of *penicillatus;* mastoids small (ratio of mastoid breadth to basilar length of Hensel, 73.9; of intermastoid breadth, 48.4); interparietal broadly and flatly pentagonal, more than twice as broad as long (ratio of length to breadth, 47.9); audital bullæ separated by less than full breadth of basisphenoid; nasals ending posteriorly about on a line with nasal branch of premaxillaries; anterior, posterior, and median borders of parietals subequal; palatines noticeably thinner than rest of palate. Coronoid process of mandible very small. Upper molar series straight. Lower premolar smaller than last molar, its crown subtriangular, broader than long, and very much narrower anteriorly than posteriorly.

General remarks.—Perognathus spinatus may be distinguished at a glance from all other known species of the *penicillatus* group by the large size of the *spines* on its rump. These spines are arranged in three groups, and are of two kinds, namely: (a) elongated black-tipped bristles, with fine awn points, occupying the middle region of the rump on and near the median line; *and (b) long* white spines occupying the sides of the *rump and situated a little* posteriorly to the first mentioned. The white spines are about 12^{mm} in length, and project far beyond the hairs. All the spines are grooved longitudinally. *P. obscurus* and *P. intermedius* also have rump spines, but they are much smaller and less conspicuous than in *spinatus*. *Perognathus spinatus* is the type of the subgenus *Chætodipus* described in the early part of this paper (see p. 5).

PEROGNATHUS PENICILLATUS Woodhouse.

Perognathus penecillatus Woodhouse, Proc. Acad. Nat. Sci. Phila., 1852, 200. Type from San Francisco Mountain, Arizona.

Perognathus penicillatus Woodhouse, Rept. Expd. Zuñi and Colorado Rivers, Sitgreaves, 1853, 49–50, pl. 3 (based on same specimen as above).

Baird, Mammals N. Am., 1857, 418, 419, pl. xx, Fig. 5.

Coues, Proc. Acad. Nat. Sci. Phila., 1875, 287–292.—Coues, Monographs N. Am. Rodentia, 1877, 504–509.

Type No. 2676 ♂ ad. U. S. National Museum (*mounted*, skull inside.) From San Francisco Mountain, Arizona, 1851. Dr. S. W. Woodhouse.

Measurements (from Woodhouse).—Head and body, 89^{mm}; tail vertebræ 115 [pencil, 15]; hind foot 25.5.

General characters.—Size large; tail crested-penicillate, its vertebræ much longer than head and body; ears rather large, nearly naked; antitragal lobe higher than broad; soles naked; pelage moderately coarse.

Color.—Above, "dull light yellowish-brown, or tawny, lined with dark brown;" below, including fore legs and feet, white to base of hairs; no lateral stripe. Tail bicolor: above, "dark brown;" below, white; pencil brown all round.

Cranial and dental characters.—Unknown (skull inside of mounted specimen).

General remarks.—The above described type of *P. penicillatus* (still in the U. S. National Museum) agrees almost precisely in size, proportions, and coloration (allowing a little for fading) with a recent specimen from the Lower Colorado, which will be here described in order to put on record its cranial characters so that they may be available for comparison with those of other members of the penicillatus group.

No. $\frac{6581}{6206}$ ♂ ad. From Lower Colorado River, Arizona (Norton's, about 25 miles north of Yuma), March 28, 1889. Vernon Bailey.

Measurements (taken in flesh by collector).—Total length, 207; tail vertebræ, 115; pencil, 17; hind foot, 25; ear from crown, 5.5 (taken from dry skin).

General characters.—Size, large; tail, crested-penicillate; its vertebræ longer than head and body; ears large, nearly naked; antitragal lobe higher than broad, a small tragal lobe; sole naked; whiskers long, extending beyond shoulders; pelage moderately coarse, not becoming bristly on rump; no spines anywhere.

Color.—Above, drab-gray, faintly suffused with light tawny, and finely lined with dusky; below, including fore legs and feet, pure white to base of hairs; no lateral stripe. Tail sharply bicolor: above, dusky; below, white; pencil dusky all round.

Cranial and dental characters.—Skull large, rather flat; mastoids small (ratio of mastoid breadth to basilar length of Hensel 69.1; of intermastoid breadth 45); audital bullæ separated anteriorly by full breadth of basisphenoid; interparietal broadly pentagonal, more than twice as broad as long (ratio of length to breadth 46.6); nasals not reaching so far back as nasal branch of premaxillaries; anterior and posterior borders of parietals subequal in length. Coronoid process of mandible moderately developed, rather thick. Lower premolar larger than last molar; crown broader than long,[*] narrower anteriorly than posteriorly; first molar a little larger than second; third about half as large as second.

General remarks.—It must be borne in mind that the skull of Woodhouse's type has not been examined, and consequently that there is a possibility,[†] however remote, that it differs in important particulars from the one here described. This point can not be absolutely settled until either the skull is removed from the mounted type or additional specimens are collected from the type locality, San Francisco Mountain, Arizona. This locality is about 230 miles distant from the point on the Lower Colorado River where the specimen here described was obtained.

PEROGNATHUS HISPIDUS Baird.

Perognathus hispidus Baird, Mamm. N. Am., 1857, 421–422 (*type* from Charco Escondido, Mexico).

Type No. $\frac{677}{1696}$ ♀ U. S. National Museum. From Charco Escondido, Mexico. Collected by Lieut. D. N. Couch.

Measurements.—Head and body, 79^{mm}; tail, 72+ (terminal portion broken off); hind foot, 21.5 (taken in flesh by collector); ear from crown, 4.5 (measured from dry skin).

General characters.—Size, rather large, about equaling *P. formosus*; hind foot *remarkably broad and short*; tail probably a little longer than head and body, not crested-penicillate; ears moderate, thick; antitragus lobed; soles naked; pelage harsh, but not much coarser than in *P. paradoxus*.

Color.—"Above, mixed cinnamon and black," not unlike *paradoxus*; a fulvous lateral stripe; under parts, including fore legs and feet, white to roots of hair. Tail distinctly bicolor: above, dark; below, whitish.

Cranial and dental characters.—Skull large; vault of cranium nearly flat; mastoids moderately developed—larger than in the *penicillatus* group, but not so large as in *olivaceus* and *fasciatus;* interparietal broadly pentagonal (ratio of length to breadth 54.2); audital bullæ separated anteriorly by full breadth of basisphenoid; nasals not extending so far posteriorly as nasal branch of premaxillaries. Coronoid process of mandible long and sharp; condylar ramus nearly horizontal, upper edge turned down posteriorly. Lower premolar larger than last molar, its crown squarish; second lower molar a little larger than first.

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[*] Specimens from the Colorado Desert in California, and from the Lower Colorado River region in Arizona from Fort Mojave northward, have the crown of the lower premolar longer than broad, while those from the region about Yuma have the crown broader than long. Possibly these two forms are deserving of separation, but it is deemed best to await the actual determination of this and other characters until specimens of *penicillatus* are secured from the type locality (San Francisco Mountain).

[†] This possibility is suggested by the very close external resemblance of P. formosus and *P. californicus, species which really* belong to widely different sections of the *genus, as shown by their cranial characters.*

NOTE.—Professor Baird included under the head of *P. hispidus* another specimen, collected at Matamoras, Mexico, by Dr. Berlandier, which I am by no means convinced is specifically the same. This specimen (No. [illegible] U. S. National Museum) is not considered here. The above description, both of skin and skull, rests solely on Baird's type from Charco Escondido. Its skull, unfortunately, is broken in two transversely at the fronto-parietal suture. Both ends remain, however, together with the jaws, so that the important characters may still be seen.

PEROGNATHUS PARADOXUS sp. nov.

Perognathus fasciatus Baird [*not* of Max. Wied], Mammals N. Am., 1857, 420–421.

Type $\frac{240}{1344}$ ♀. Trego County, Kansas, October 17, 1884. A. B. Baker.

Measurements.—Head and body, 100; tail vertebræ, 105; hairs, 2.5 (taken in flesh by collector); hind foot, 26; ears from crown, 5.5 (from dry skin).

General characters.—Largest known species; ears large, with antitragal lobe higher than broad; tail a little longer than head and body, not crested or penicillate; soles naked along the median line, but hairs on sides of heel concealing the bare portion; pelage harsh; whiskers short.

Color.—Above, yellowish-brown, coarsely lined with black; sides fulvous; under parts, including fore feet, white to base of fur. Tail bicolor: above, fuliginous; below, whitish.

Cranial and dental characters.—Skull large and heavy, moderately arched, much higher than that of any other species, with a slightly elevated supra-orbital ridge or bead; mastoids relatively small (ratio of mastoid breadth to basilar length of Hensel 66.2; of intermastoid breadth 37.9); interparietal large and broadly pentagonal (ratio of length to breadth 56.3); audital bullæ separated by less than full breadth of basisphenoid; nasals ending posteriorly almost on a line with nasal branch of premaxillaries; median border of parietal longest; coronoid process of mandible long, hooked, and directed strongly outward. Lower premolar about the size of last molar (possibly a little smaller), its crown squarish, a little narrower anteriorly than posteriorly. Second molar slightly larger than first. [This is much more noticeable in the young before the cusps have been worn down.] Arranged in order of size, the lower molariform series stands as follows, beginning at the largest: m 2, m 1, m 3, pm.

General remarks.—This is the species which Baird wrongly identified as *P. fasciatus* Max. Wied, by which name it has been known to the present time, as already explained in the introductory portion of this paper. It is the largest of the group. Its skull departs somewhat from the type exhibited by the other species, as may be seen from the accompanying figure. This is due principally to the mastoids, which are relatively smaller than those of any other species except *californicus*. As in *californicus*, also, the cranium is conspicuously broader just in front of the auditory meatus than posteriorly; in all other species it is only slightly broader at this point. The well-marked supra-orbital bead is found in no other species, though it exists also in the subspecies *spilotus*.

Baird's original specimen from Chihuahua (No. 1061, U. S. Nat. Mus.) agrees surprisingly well with specimens from western Kansas, the only noticeable difference being that its tail is less distinctly bicolor, is more heavily haired, and the hairs are somewhat longer.

PEROGNATHUS PARADOXUS SPILOTUS subsp. nov.

Type, skin, 5293 ♀ ad. From Gainesville, Cook County, Texas; October 8, 1886. G. H. Ragsdale.

Skull 23096 ♀ yg. ad. U. S. Nat. Mus. Gainesville, Cook County, Texas. G. H. Ragsdale.*

Measurements.—Total length, 196; tail, 95 (taken in flesh by collector); hind foot, 23; ear, from crown, 5 (from dry skin).

General characters.—Size a little smaller than *P. paradoxus;* proportions about as in that species; soles naked.

Color.—Above, dark yellowish-brown, heavily and coarsely lined with black. Fulvous side stripe darker and broader than in *paradoxus*, encroaching well upon the belly and including the fore legs. Tail sharply bicolor: above, fuliginous; below, yellowish-white. The ears are ornamented by a blackish spot near the middle of the incurved upper surface.

Cranial and dental characters.—Skull slightly smaller than that of *paradoxus;* narrower (ratio of mastoid breadth to basilar length of Hensel, 63; of intermastoid breadth, 37.3); nasals narrower anteriorly, and extending posteriorly as far as the nasal branch of the premaxillaries; supra-orbital bead as in *paradoxus;* interparietal smaller and more rounded posteriorly (ratio of length to breadth 57.5); audital bullæ separated anteriorly by less than breadth of basisphenoid, as in *paradoxus;* basioccipital narrower anteriorly; frontal border of parietal longest. Mandible lighter, with condylar ramus shorter and directed much more obliquely upward; angle less spreading. Dentition as in *P. paradoxus*.

General remarks.—*Perognathus paradoxus spilotus* is a well-marked

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*Unfortunately, my skins of *P. paradoxus spilotus* are not accompanied by skulls. The National Museum, however, has a skull (No. 23096) from the same locality, which has furnished the basis for the present description.

subspecies, which may be easily distinguished by its darker coloration, by the blackish spot on each ear, by the shortness of its hind foot, and by the fact that the tan-colored lateral stripe extends out on the fore leg to the wrist, while in *P. paradoxus* the fore leg is entirely white. Its darker coloration and spotted ears make it a much handsomer animal than *P. paradoxus*.

PEROGNATHUS CALIFORNICUS sp. nov.

? *Cricetodipus parvus.* Peale, Rept. Mamm. and Ornith., U. S. Expl. Expd., Wilkes, VIII, 1848, 52–54.

Type $\frac{4133}{5627}$ ♀. Berkeley, California. Nov. 8, 1888. T. S. Palmer and Charles A. Keeler.

Measurements.—Total length, 186^{mm} (end of tail broken off); hind foot, 24; ear, 6. [Another specimen from same place, No. 5613 ♂: Total length, 195; tail vertebræ, 101; hind foot, 24; ears, 6.5.]

General characters.—Size, large; ears very large, with antitragal lobe considerably higher than broad; tail vertebræ longer than head and body; tail slightly crested and penicillate; pelage harsh, with white spines on the sides of the rump; soles broad, naked to heel.

Color.—Above, dark grizzled yellowish-brown, lined with black; below, white to base of hairs; a pale fulvous lateral stripe; color of the back reaching elbows. Tail sharply bicolor, sooty-black above, white beneath.

Cranial and dental characters.—Skull long and narrow, much arched; mastoids very small (ratio of mastoid breadth to basilar length of Hensel, 74; of intermastoid breadth, 48); interparietal large, convex posteriorly, about twice as broad as long (ratio of length to breadth, 50.5), occiput projecting considerably behind mastoids; audital bullæ separated anteriorly by full breadth of basisphenoid; nasals deeply emarginate posteriorly, not reaching quite so far back as nasal branch of premaxillaries; anterior and posterior borders of parietal longest and subequal; coronoid process of mandible short; condylar ramus nearly horizontal. Lower premolar slightly larger than last molar; its crown longer than broad and narrower anteriorly than posteriorly; anterior cusp well separated from posterior; first molar larger than second; third more than half as large as second.

General remarks.—This species, which has been heretofore confounded with *P. monticola* of Baird, resembles *P. formosus* in size and color, though darker, and having a shorter, less crested, and more sharply bicolor tail, which is blackish above from the very base, instead of on the terminal half only. Its skull differs materially from that of any other member of the group, and approaches *P. paradoxus* more closely than any other species. The white spines on the sides of the rump are about as large as in *P. fallax*.

PEROGNATHUS ARMATUS sp. nov.

Type [illegible] ♀ ad. Mount Diablo, California, March 28, 1882. W. E. Bryant.

Measurements.—Total length, about 160; head and body, about 70; tail vertebræ, about 90; pencil, 15; hind foot, 24; ear from crown, 7 (from well-made skin).

General characters.—Size a little smaller than *P. californicus*; ears very large, with antitragal lobe higher than broad; tail crested-penicillate; its vertebræ much longer than head and body; soles broad, naked to heel; pelage coarse, with white spines on the flanks and sides of the rump.

Color.—Above, very dark-grizzled yellowish-brown, heavily lined with black (much darker than any other species); below, white to roots of hairs; a very pale fulvous lateral stripe, which reaches upper surface of fore leg. Tail sharply bicolor: above, sooty; below, white; pencil, dark all round.

Cranial and dental characters.—The occipital portion of the skull is absent, together with part of the interparietal, so that no important measurements or ratios can be taken. The mastoids are small, and the audital bullæ are separated anteriorly by nearly the full breadth of the basisphenoid. The parietals are longer on the sagittal suture than in *californicus*; in fact, the anterior, median, and posterior borders of the parietal are fairly subequal. Coronoid process of mandible short and stout. Lower premolar larger than last molar, its crown longer than broad, with the anterior cusp well separated from the posterior, as in *californicus*.

General remarks.—*P. armatus* differs from *P. californicus* in smaller size, with relatively larger hind feet and ears; in darker color, and in the forward extension of the white spines along the flanks almost to the middle of the body. The color of the upper parts does not extend so far down on the sides as in *californicus*. The greater length of the parietals along the median line is another character of importance. Possibly future collections will show that *P. armatus* grades into *P. californicus*. If so, it will have to stand as a subspecies.

UNDETERMINED SPECIES.

In order to complete the present revision of the group I here introduce descriptions of the three remaining species which have been named but which I have not seen. Whether they all refer to the same species, and what their nearest congeners are, can not be determined from the material now at hand. None of their skulls have been described. All three came from the Pacific province, from northern California northward.*

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*Nearly fifteen years ago Coues made the following statement, which is equally true to-day: "*Specimens of any Saccomyine form from Oregon and Washington Territory are at present special desiderata.*"

PEROGNATHUS PARVUS (Peale).

Cricetodipus parvus Peale, Rept. Mamm. and Ornith., U. S. Expl. Expd., Wilkes, VIII, 1848, 52–54.

The type of Peale's *Cricetodipus parvus* is supposed to be not extant. It was a very young animal; as shown in an early part of the present paper (under *History and Nomenclature*, p. 3, foot-note), and its measurements indicate that it was one of the larger species of the group.

Following is Peale's original description:

> Head ovate; the snout elongate, pointed, and covered with hair, excepting the nostrils, which are small and convolute; lips large, tumid, and covered with short hairs; whiskers numerous, white; a tuft of white hairs or bristles on the chin; cheek-pouches spacious, opening outside of the mouth, and reaching from the upper lip to the throat; the cavity extending backwards to the ears, and lined with hair; eyes medium size; ears small, round, and fringed with hairs; fore legs small, the feet moderate, margined with bristly hairs; the nails short, curved, excepting that of the thumb, which is orbicular, or resembling the human thumb-nail; hind legs long; the feet large and strong, five-toed; the middle one slightly longer than the rest; inner toe shortest, reaching only to the end of the metatarsal bones of the others; all the nails short, pointed, and slightly curved; tail long, tapering, and clothed with short silky hairs. Color above, sepia-brown; beneath, white; a dark line crosses the cheeks beneath the eyes.
>
> Length of the head and body, $1\frac{9}{10}$ inch; head from the nose to the occiput, $\frac{9}{10}$ inch; ears, $\frac{2}{10}$ inch; tail, $2\frac{3}{10}$ inches; fore leg from the elbow, $\frac{9}{20}$ inch; fore foot, $\frac{3}{10}$ inch; tibia, $\frac{7}{10}$ inch; hind foot, $\frac{8}{10}$ inch; metatarsus, $\frac{5}{10}$ inch.*
>
> A single specimen of this singular animal was obtained in Oregon, but no notes were furnished by the person who obtained it. The formation of its hind legs leaves but little room to doubt that its habits are similar to the jumping mice, *Meriones Labradorius* (Richardson), which are inhabitants of the same region. Its singularly large head, which equals its body in bulk, its ample cheek-pouches, long hind legs, and long tail, present a general form which is peculiar and altogether very remarkable. On dissection, the stomach was found to contain a pulpy matter, which appeared to be the remains of a bulbous root; the liver is very large, and consists of five foliaceous lobes; we were not able to detect any gall-bladder. The specimen is a female, and presents the rudiments of a fourth molar tooth in each side of the lower jaw, which would eventually have replaced the front ones, already much worn. (*Peale*, Rept. Mamm. and Ornith., U. S. Expl. Expd., Wilkes, VIII, 1848, 53–54.)

PEROGNATHUS LORDI (Gray).

Abromys lordi Gray Proc. Zool. Soc. London, May, 1868, 202 (type from British Columbia).

Gray's description of this animal is as follows:

> Fur soft, abundant, gray-washed, with blackish tips; chin and under side of body whitish; tail tapering, gray, with blackish-brown upper surface and tip; hair of the back dark lead-colour, with a short gray band and minute black tip. * * * The teeth destroyed. Length of body and head 3 inches; of tail 3 inches. It differs from *Dipodomys phillipsii* and other species of that genus in having no white spot over the eye at the base of the ear, or white band across the thigh.

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* The most important of these measurements, reduced to millimeters, are: Head and body, 48; head from nose to occiput, 23; tail, 58; hind foot, 20.5.

Mr. Oldfield Thomas, curator of mammals in the British Museum, has had the kindness to re-examine, at my request, the type of *Abromys lordi*, and his letter in regard to the same has reached me just as this manuscript is about to go to press. Mr. Thomas writes:

> I have the type of *Abromys lordi* before me. It is a *Perognathus*, and, so far as I can make out from Coues's description, is the same as *P. monticola*.[*] Its dimensions are: Head and body, 74^{mm}; tail vertebræ (perfect), 81^{mm}; hind foot with claw, 21.8; ear from crown, 6.5. The ear appears to be just as Coues describes, with a marked antitragus, but no anterior projecting lobule. The distance from the tip of the nasals to the back of one of the bullæ is 25.5^{mm}.

PEROGNATHUS MOLLIPILOSUS Coues.

Perognathus monticola Coues, Proc. Acad. Nat. Sci. Phila., 1875, 293–296.

Perognathus mollipilosus Coues, Proc. Acad. Nat. Sci. Phila., 1875, 296 (provisional name, based on specimen from Fort Crook, Cal.).—Coues, Monographs N. Am. Rodentia, 1877, 509–512 (same as above).

Type No. 7251 ♀, U. S. National Museum, Fort Crook, Cal.[†]

Measurements.—(From Coues) Head and body, 64; tail vertebræ, 82; hind foot, 20.5.

General characters.—(From Coues) Size rather small; tail vertebræ longer than head and body; tail not crested-penicillate; "antitragus with a great, flat, rounded, upright lobe"; pelage very soft and smooth; soles naked.

Color.—(From Coues) "Above yellowish-cinnamon lined with blackish, the latter predominating; below, white"; "color of upper parts descending on the fore leg to the wrist"; a pale fulvous lateral stripe; "tail bicolor to correspond with the body colors."

Cranial and dental characters.—(Not given.)

General remarks.—My opinion is that this animal will prove to be identical with *P. lordi*, and both may be the same as *P. parvus* of Peale.

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[*] As I have already pointed out, *P. monticola* of Coues is a very different animal from *P. monticola* of Baird, and must stand as *P. mollipilosus*, which see.

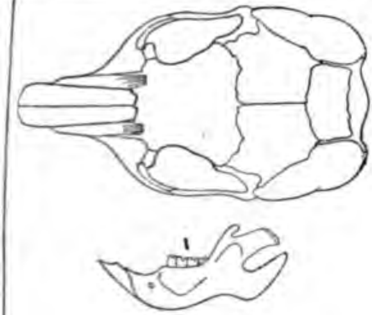
[†] This specimen should be in the National Museum, but Mr. F. W. True, curator of mammals, informs me that its number is wrong, and that it cannot be found.

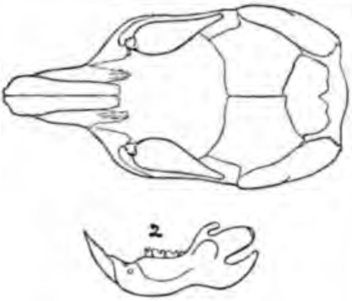
PLATE I.

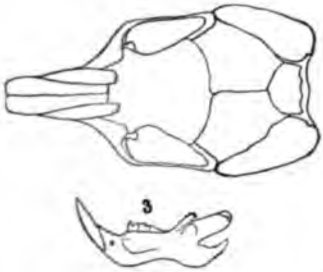
(All double natural size.)

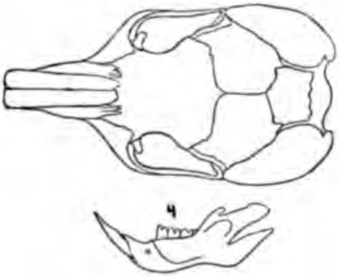
1. (4445) ♂ *Perognathus fasciatus* Max. Wied. *Duplicate type.* Fort Buford, Da
2. (5027) ♂ *Perognathus fasciatus flavescens* Merriam. *Type.* Kennedy, Nebr.
3. (5047) ♂ *Perognathus flavus* Baird. Mason, Tex.
4. (3572) ♂ *Perognathus longimembris* Coues. San Bernardino, Cal.
5. (4984) ♂ *Perognathus apache* Merriam. *Type.* Apache County, Ariz.
6. (23790) ♂ *Perognathus inornatus* Merriam. *Type.* Fresno, Cal.
7. (5827) ♀ *Perognathus californicus* Merriam. *Type.* Berkeley, Cal.

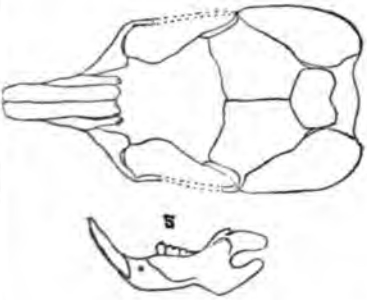
PLATE I.

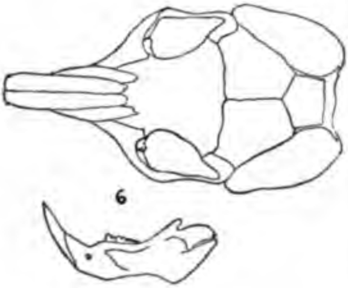












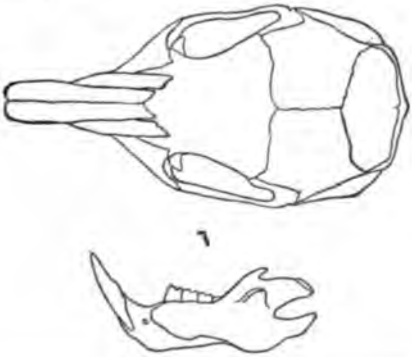
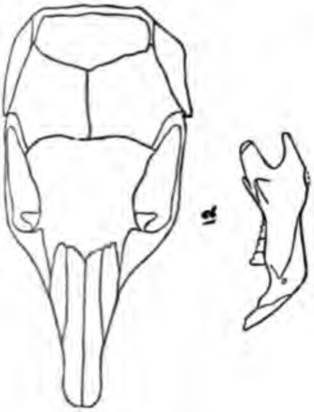


PLATE II.

(All double natural size.)

8. (5623) ♂ ***Perognathus olivaceus*** **Merriam.** ***Type.*** **Kelton, Utah.**
9. (5795) ♂ ***Perognathus olivaceus amœnus*** **Merriam.** ***Type.*** **Nephi, Utah.**
10. (1585) ♀ ***Perognathus monticola*** **Baird.** ***Type.*** **St. Mary's Mission, Montana.**
11. (5908) ♂ ***Perognathus formosus*** **Merriam.** ***Type.*** **St. George, Utah.**
12. (22684) ♂ ***Perognathus fallax*** **Merriam.** ***Type.*** **San Bernardino, Cal.**
13. (6000) ♂ ***Perognathus intermedius*** **Merriam.** ***Type.*** **Mud Spring, Arizona.**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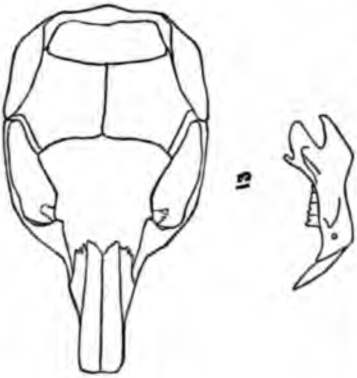
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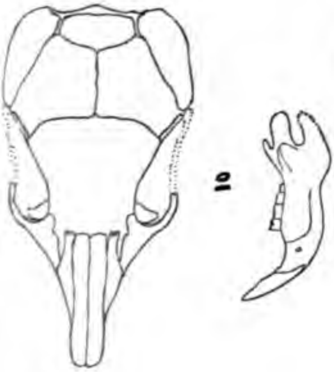
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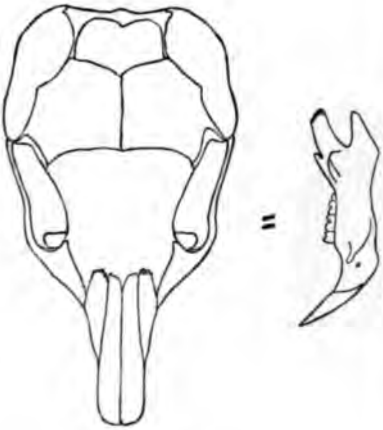
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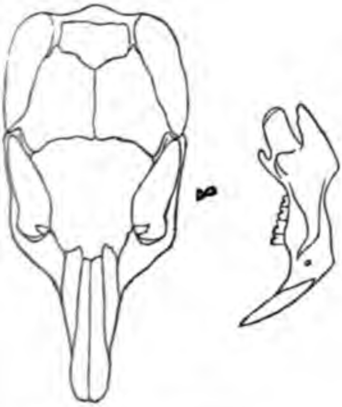
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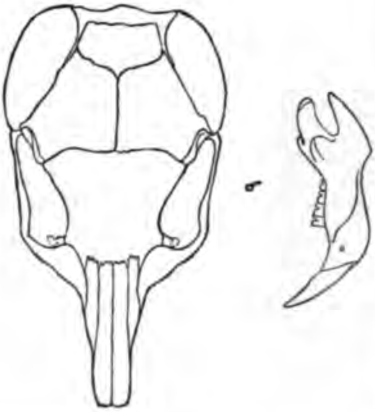
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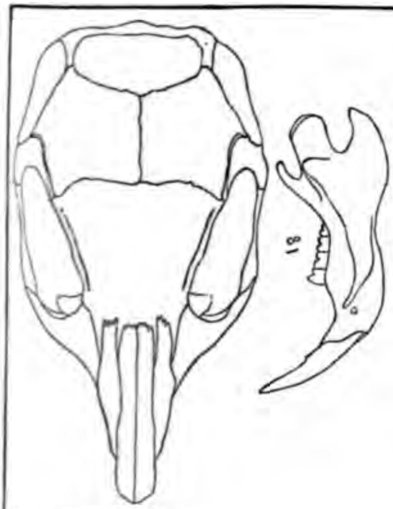
PLATE III.

(All double natural size.)

14. (2848) ♀ *Perognathus obscurus* Merriam. *Type.* Grant County, N. Mex.
15. (6137) ♂ *Perognathus spinatus* Merriam. *Type.* Lower Colorado River, Arizona.
16. (6206) ♂ *Perognathus penicillatus* Woodhouse. Lower Colorado River, Arizona.
17. (1696) ♀ *Perognathus hispidus* Baird. *Type.* Charco Escondido, Mexico.
18. (1544) ♀ *Perognathus paradoxus* Merriam. *Type.* Trego County, Kans.
19. (23096) ♀ *Perognathus paradoxus spilotus* Merriam. *Type.* Cook County, Tex.



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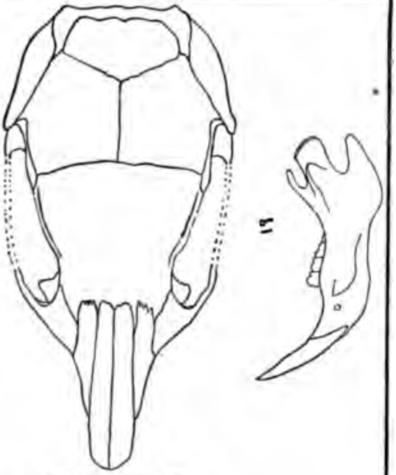

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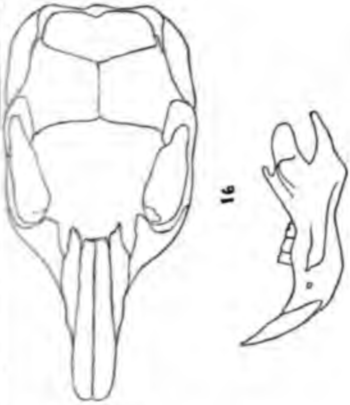

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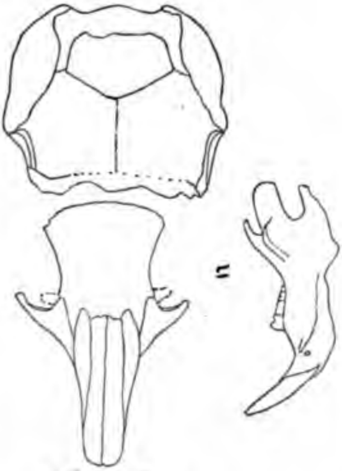

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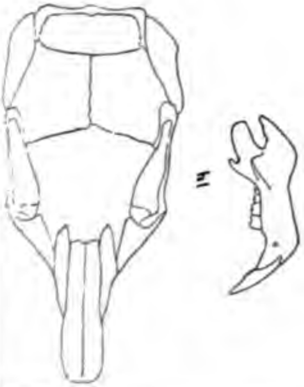

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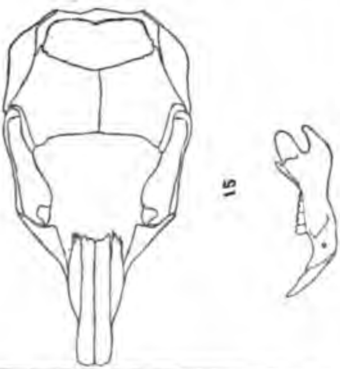

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PLATE IV.

(Enlarged about ten times.)

Perognathus* (*Chætodipus*) *obscurus Merriam. (All from Apache, Grant County, New Mexico.)

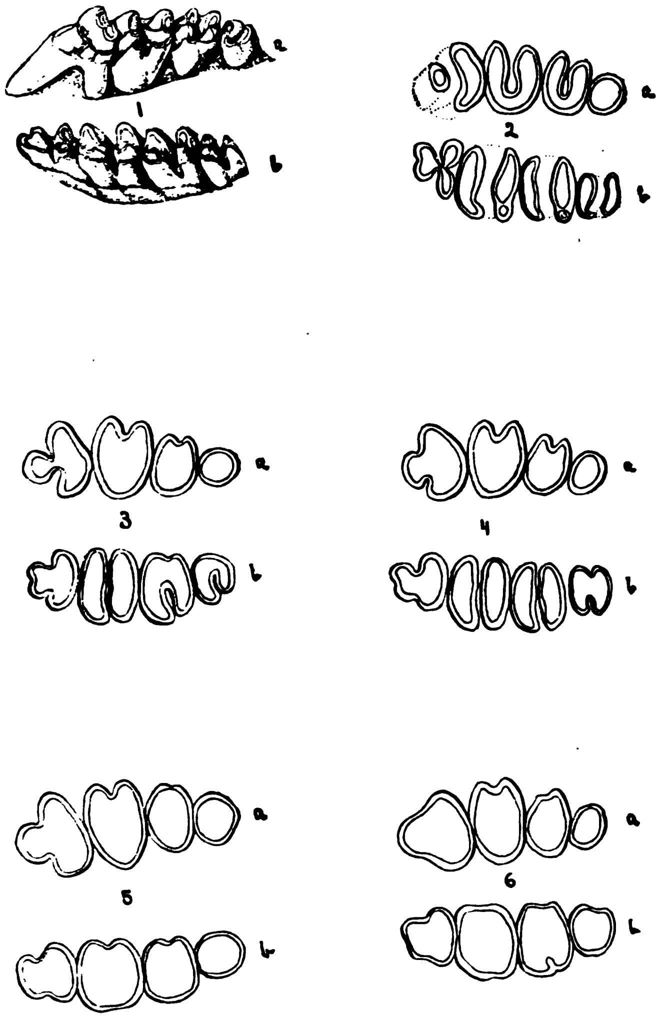
a = left upper molariform series.

b = left lower molariform series.

Fig. 1 (skull No. 2855). *Young* (viewed obliquely from the side). Shows the long deciduous premolar in the under jaw, and also the tri-tuberculate cusps of the molars, which are early worn away, leaving the crowns flat (as shown in the succeeding figures).

Figs. 2, 3, 4, 5, and 6 are *camera lucida* outlines of the crowns of the teeth, showing successive stages of wear. In Fig. 2 the permanent lower premolar has just reached the level of the crowns of the other teeth.

Fig. 2 (skull No. 2854); 3 (2853); 4 (2851); 5 (2848 *type*); 6 (2849).



Perognathus (Chætodipus) obscurus Merriam.

From Grant County, New Mexico.

Molariform teeth showing the changes of form and outline resulting from the wearing down of the crowns with age.

MEASUREMENTS.

All measurements of specimens are in millimeters.

All Mammals collected by Field Agents of the Division are measured in accord with the following instructions:

(1) The total length is the distance between the tip of the nose and the e the tail vertebræ. It is taken by laying the animal on a board, with its nose ag a pin or upright post, and by straightening the back and tail by extending the legs with one hand while holding the head with the other; a pin is then driven the board at the end of the vertebræ.

(2) The length of tail is the length of the caudal vertebræ. It is take erecting the tail at right angle to the back, and placing one point of the divide the backbone at the very root of the tail, the other at the tip end of the vertebr

(3) The hind foot is measured by placing one point of the dividers against end of the heel (*calcaneum*), the other at the tip of the longest claw, the foot b flattened for this purpose.

In measuring the hind foot in dry skins, the foot is first wrapped in wet absor cotton until the toes can be straightened.

J O Snyd

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 2

[Actual date of publication, October 30, 1889]

Descriptions of fourteen new species and one new genus of North American Mammals

By Dr. C. Hart Merriam

WASHINGTON
GOVERNMENT PRINTING OFFICE
1889

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All measurements of specimens are in millimeters.

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(1) The TOTAL LENGTH is the distance between the tip of the nose and the end of the tail vertebræ. It is taken by laying the animal on a board, with its nose against a pin or upright post, and by straightening the back and tail by extending the hind legs with one hand while holding the head with the other; a pin is then driven into the board at the end of the vertebræ.

(2) THE LENGTH OF TAIL is the length of the caudal vertebræ. It is taken by erecting the tail at right angle to the back, and placing one point of the dividers on the backbone at the very root of the tail, the other at the tip end of the vertebræ.

(3) The HIND FOOT is measured by placing one point of the dividers against the end of the heel (*calcaneum*), the other at the tip of the longest claw, the foot being flattened for this purpose.

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U. S. DEPARTMENT OF AGRICULTURE, *July* 17, 1889.

IR: I have the honor to transmit herewith No. 2 of NORTH AMERI- FAUNA. It contains descriptions of a new genus, twelve new cies, and one new sub-species; and also a diagnosis of the genus *chomys*, and a synopsis of the known forms.

Respectfully,

C. HART MERRIAM,
Chief of Division of
Ornithology and Mammalogy.

on. J. M. RUSK,
Secretary of Agriculture.

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VI. Figs. 1 and 2, *Phenacomys intermedius* (teeth).
VII. Figs. 1 and 2, *Phenacomys intermedius* (teeth and skull).
VIII. Figs. 1-4, *Lagomys schisticeps* (skull); figs. 5 and 6, *Lagomys princeps* (skull); figs. 7 and 8, *Arctomys dacota* (skull).

No. 2. NORTH AMERICAN FAUNA. October, 1889.

DESCRIPTIONS OF TWO NEW SPECIES AND ONE NEW SUBSPECIES OF GRASSHOPPER MOUSE,

WITH A DIAGNOSIS OF THE GENUS ONYCHOMYS, AND A SYNOPSIS OF THE SPECIES AND SUBSPECIES.

By C. HART MERRIAM, M. D.

A. DESCRIPTIONS OF NEW SPECIES AND SUBSPECIES.

ONYCHOMYS LONGIPES sp. nov.

(TEXAS GRASSHOPPER MOUSE.)

Type $\frac{3597}{4735}$ ♀ ad. Merriam Collection. Concho County, Texas, March 11, 1887. Collected by William Lloyd.

Measurements (taken in the flesh by collector).—Total length, 190^{mm}; tail, 48 [this measurement seems to be too short]; hind foot, 25; ear from crown, 13 (measured from dry skin).

General characters.—Size larger than that of the other known representatives of the genus, with larger and broader ears, and much longer hind feet. Ears less hairy than in *O. leucogaster*, with the lanuginous tuft at base less apparent; tail longer and more slender.

Color.—Above, mouse gray, sparingly mixed with black-tipped hairs, and with a narrow fulvous stripe along each side between the gray of the back and white of the belly, extending from the fore-legs to the root of the tail; under parts white.

Cranial characters.—Skull longer and narrower than that of *O. leucogaster* (particularly the rostral portion), with much longer nasals, and a distinct supraorbital "bead" running the full length of the frontals and there terminating abruptly. The nasals overreach the nasal branch of the premaxillaries about as far as in *leucogaster*. The incisive foramina, as in *O. leucogaster*, barely reach the anterior cusp of the first molar. The roof of the palate extends further behind the last molar than in *leucogaster*, and gives off a median blunt spine projecting into the pterygoid fossa. The palatal bones end anteriorly exactly on a line with the interspace between the first and second molars. The presphenoid is excavated laterally to such a degree that the middle portion is reduced to a narrow bar less than one-third the width of its base. The condylar ramus is lower and more nearly horizontal than in *leucogaster*, and the angular notch is deeper. The coronoid process resembles that of *leucogaster*.

ONYCHOMYS LONGICAUDUS sp. nov.

(LONG-TAILED GRASSHOPPER MOUSE.)

Type $\frac{4391}{5896}$ ♂ ad. St. George, Utah, January 4, 1889. Collected by Vernon Bailey.

Measurements (taken in the flesh by the collector).—Total length, 145; tail, 55; hind foot, 20; ear from crown, 10 (measured from dry skin).

General characters.—Similar to *O. leucogaster*, but smaller, with longer and slenderer tail. Pelage longer, but not so dense. General color above, cinnamon-fawn, well mixed with black-tipped hairs.

Cranial characters.—Skull smaller and narrower than that of *O. leucogaster;* zygomatic arches less spreading; nasals less projecting behind nasal branch of premaxillaries. The coronoid and condylar processes of the mandible are shorter, and the coronoid notch is not so deep as in *leucogaster*. The presphenoid shows little or no lateral excavation. The incisive foramina do not quite reach the plane of the anterior cusp of the first molar. The shelf of the palate projects posteriorly considerably beyond the molars, and terminates in a nearly straight line without trace of a median spine.

ONYCHOMYS LEUCOGASTER MELANOPHRYS subsp. nov.

(BLACK-EYED GRASSHOPPER MOUSE.)

Type, $\frac{5132}{5894}$ ♂ ad. Kanab, Utah, December 22, 1888. Collected by Vernon Bailey.

Measurements (taken in the flesh by collector).—Total length, 154; tail, 41; hind foot, 21. Ear from crown 10 (measured from the dry skin).

Size of *O. leucogaster*. Ear a little smaller. Hind foot densely furred to base of toes. Color above, rich tawny cinnamon, well mixed with black-tipped hairs on the back, and brightest on the sides; a distinct black ring round the eye, broadest above. This ring is considerably broader and more conspicuous than the very narrow ring of *leucogaster*.

Cranial characters.—Skull large and broad; very similar to *O. leucogaster* in size and proportions, but with zygomatic arches less spreading posteriorly, interparietal narrower, nasals not reaching quite so far beyond the nasal branch of premaxillaries, and antorbital slit narrower. Presphenoid moderately excavated, as in *leucogaster*. The incisive foramina reach past the plane of the first cusp of the anterior molar. The condylar ramus is longer and directed more obliquely upward than in *leucogaster*, with the coronoid and infra-condylar notches deeper.

NOTE.—In order to render the preceding diagnoses of new forms more useful, the following brief descriptions of the skulls of the two viously known species are appended for comparison, together with gures of the skull of the type of the genus (*O. leucogaster*):

Onychomys leucogaster Max.—Skull large and broad, with zygomatic arches spreading posteriorly. Antorbital slit larger than in the other known species. Palate rt, ending posteriorly in a short median spine (see figure).

Onychomys torridus Coues.—Skull small, narrow, with zygomatic arches not spreading, and vault of cranium more rounded than in any other member of the genus. Interparietal relatively large. Nasals projecting far beyond nasal branch of premaxillary. Incisive foramina very long, extending back to second cusp of first molar. lf of palate produced posteriorly nearly as far as in *longicaudus*, and truncated. sphenoid slightly excavated laterally. Mandible much as in *longicaudus*, but ith coronoid process more depressed and condylar ramus more slender.

B. DIAGNOSIS OF THE GENUS ONYCHOMYS.

The striking external differences which distinguish the Missouri Grasshopper Mouse from the other White-footed Mice of America (*Hesperomys* auct.) led its discoverer, Maximilian, to place it in the genus *Hypudæus* (=*Evotomys*, Coues), and led Baird to erect for its reception a separate section or subgenus, which he named *Onychomys*. Coues, the only recent monographer of the American Mice, treats *Onychomys* as a subgenus, and gives a lengthy description of its characters. Since, however, some of the statements contained in this description are erroneous, and the conclusions absurd,* and since the most important taxonomic characters are overlooked, it becomes necessary to redefine the type. A somewhat critical study of the cranial and dental characters of *Onychomys* in comparison with the other North American White-footed Mice has compelled me to raise it to full generic rank. It may be known by the following diagnosis:

Genus ONYCHOMYS Baird, 1857.

Baird, Mammals of North America, 1857, p. 457 (*subgenus*).
Type, *Hypudæus leucogaster*, Max. Wied, Reise in das innere Nord Amerika, II, 1841, 99–101 (from Fort Clark, Dakota).
Hesperomys auct.

First and second upper molars large and broad; third less than half the size of the second. First upper molar with two internal and three external cusps, the anterior cusp a trefoil when young, narrow, and on a line with the outside of the tooth, leaving a distinct step on the inside. Second upper molar with two internal and two external cusps, and a narrow antero external fold. Last upper molar subcircular in outline, smaller than in *Hesperomys*, and less indented by the lateral notches.

---

* Coues says: "Although unmistakably a true Murine, as shown by the cranial and other fundamental characters, it nevertheless deviates much from *Mus* and *Hesperomys*, and approaches the Arvicolines. Its affinities with *Evotomys* are really close." (Monographs of North American Rodentia, 1877, p. 106.) As a matter of fact, *Onychomys* has no affinities whatever with *Evotomys*, or any other member of the Arvicoline series, its departure from *Hesperomys* being in a widely different direction.

Lower molar series much broader than in *Hesperomys*. First lower molar with an anterior, two internal, and two external cusps, and a postero-internal loop. In *Hesperomys* the anterior cusp is divided, so that there are three distinct cusps on each side. Second lower molar with two internal and two external cusps, an antero-external and a postero-internal fold. Third lower molar scarcely longer than broad, subcircular in outline, with the large posterior lobe of *Hesperomys* reduced to a slight fold of enamel, which disappears with wear.

Coronoid process of mandible well developed, rising high above the condylar ramus and directed backward in the form of a large hook (see accompanying cut). Nasals wedge-shaped, terminating posteriorly considerably behind the end of the nasal branch of the premaxillaries.

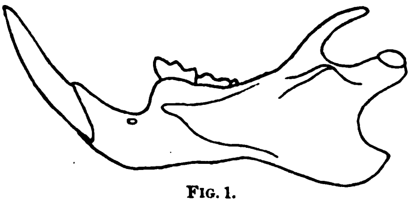

FIG. 1.

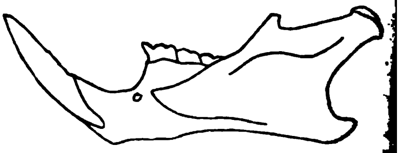

FIG. 2.

1. Lower jaw of *Onychomys leucogaster*.

2. Lower jaw of *Hesperomys leucopus*.

Body much stouter and heavier than in *Hesperomys*. Tail short, thick, and tapering to an obtuse point.

Fore feet larger than in *Hesperomys*; five-tuberculate, as usual in the Murine series. Hind feet four-tuberculate, and densely furred from heel to tubercles. Tubercles phalangeal, corresponding to the four anterior tubercles of *Hesperomys*, that is to say, the first is situated at the base of the first digit, the second at the base of the second digit, the third over the bases of the third and fourth digits together, the fourth at the base of the fifth digit. The fifth and sixth (or metatarsal) tubercles of *Hesperomys* are altogether wanting.

C. SYNOPSIS OF SPECIES AND SUBSPECIES.

(1) BY EXTERNAL CHARACTERS.

Length, about 150^{mm}; tail, about 40; hind foot, about 21; ear from crown, 10. Color above, mouse-gray; black ring around eye inconspicuous .... *O. leucogaster.*

Size of *O. leucogaster*. Color above, rich tawny cinnamon, brightest on the sides; black ring round eye conspicuous .... *O. leucogaster melanophrys.*

Length, about 145^{mm}; tail, about 55; hind foot, 20; ear from crown, 10. Color above, cinnamon fawn .... *O. longicaudus.*

Length, about 190^{mm}; tail, about 50; hind foot, 25; ear from crown, 13. Color above, mouse-gray, with a narrow fulvous stripe along the sides ...... *O. longipes.*

Length, about 135^{mm}; tail, about 45; hind foot, 20; ear from crown, 10. Color *above, uniform* dull tawny cinnamon; no black ring around the eye. Tail thick *with a dark stripe* above reaching three-fourths its length; rest of tail white. O. torridus.

(2) BY CRANIAL CHARACTERS.

ending eriorly
- with a blunt median spine
  - a distinct supraorbital bead .... *longipes.*
  - no distinct supraorbital bead .... *leucogaster.*
- with straight or slightly convex edge
  - skull large and broad .... *melanophrys.*
  - skull smaller and narrower
    - incisive foramina barely reach plane of first molar .... *longicaudus.*
    - incisive foramina reach second cusp of first molar .... *torridus.*

Cranial measurements of the known forms of the genus Onychomys.

	O. leucogaster, Fort Buford, Dakota.		Melanophrys, Kanab, Utah.		Longipes, Concho County, Texas.
	4418 ♀	4419 ♂	5893 ♂	5894 ♂	3839 ♀
length of Hensel (from foramen magnum to incisor).	22	22	22.3	21.6	23.3
tic breadth	15	15.2	15.4	15.5	15.5
t parietal breadth	12.9	12.7	12.8	12.5	12.2
bital constriction	4.5	4.5	5.2	4.8	4.4
of nasals	10.8	11.6	10.7	10.7	12.5
to post-palatal notch	12	12	11.7	11.5	12.4
n magnum to incisive foramina	14.7	14.6	15	14.5	15.7
n magnum to palate	9.7	10	10.2	9.9	10.6
of upper molar series (on alveolæ)	4.5	4.2	4.6	4.8	4.4
of incisive foramina	5	5.7	5	5	5.3
of mandible	15.5	15.8	15.7	15.3	16
of coronoid process from angle	6.5	7.3	6.8	6.8	7.2
to basilar length:					
matic breadth	68.1	69	69	71.7	66.6
ietal breadth	58.9	57.7	57.3	57	52
als	49	52.7	47.9	49.5	52.3
lar series (on alveolæ)	20.4	19	20.6	22	20
isive foramina	22.7	25.9	22.4	23.1	22.7
amen magnum to incisive foramen	66	66.3	67.3	67	67.3
amen magnum to palate	44	45.4	45.7	45.8	45.4

	Longicaudus, St. George, Utah.			Torridus, Grant County, N. Mex.
	5895 ♀	5896 ♂	5897 ♂	2839 ♂
length of Hensel (from foramen magnum to incisor)	19.3	19.3	19.4	18.5
tic breadth	13	13	13.1	12.5
t parietal breadth	11.2	11.5	11.2	11.4
bital constriction	4.7	4.7	4.8	4.2
of nasals	10	9.5	9.7	9.6
to post-palatal notch	10.5	10.5	10.4	10
n magnum to incisive foramina	13.5	13.4	13.3	12.5
n magnum to palate	8.8	8.7	8.7	8.5
of upper molar series (on alveolæ)	3.8	3.8	3.8	3.5
of incisive foramina	4.3	4.3	4.4	5
of mandible	13.4	13.5	13.2	13.2
of coronoid process from angle	6.2	6.3	6.2	5.8
to basilar length:				
matic breadth	67.3	67.3	68	67.5
ietal breadth	58	59.5	57.7	61.6
als	51.8	49.2	50	51.8
lar series (on alveolæ)	19.6	19.6	19.5	18.9
isive foramina	22.2	22.2	22.6	27
amen magnum to incisive foramen	68.3	69.4	68.5	67.5
amen magnum to palate	45.5	45	44.8	45.8

PTION OF A NEW MARMOT FROM THE BLACK HILLS OF DAKOTA.

By Dr. C. Hart Merriam.

:hree species of Marmots have been heretofore recognized in
America. They are *Arctomys monax* of the East; *A. flaviventer*
West; and *A. caligatus* (=*A. pruinosus* auct.)* of the northern
Mountains and Cascade Range from just within our northern
to the Arctic Circle.

ıame *Arctomys flaviventer* was given by Audubon and Bachman
ecimen collected by Mr. Douglas "between western Texas and
ıia," the exact locality being unknown. It was assumed by
who has been followed by subsequent authors, that all the Mar-
ıhabiting the region between the Great Plains and the Pacific
were specifically the same, excepting only the subarctic *A. cali-*
This assumption was the result of the examination of scanty and
ve material, for Baird remarked that a specimen which he had
ıe Dalles, Oregon, and which was very imperfect and in the molt,
considerably from a specimen from the Black Hills of Dakota.
ıtely, my own collectors have succeeded in securing fine series
s and skulls both from the Sierra Nevada Mountains in Cali-
ınd from the Black Hills of Dakota.

Sierra Nevada animal agrees very closely with Audubon and
an's description of *A. flaviventer*, and undoubtedly is closely re-
, if not identical with, their species. The Black Hills Marmot is
lifferent animal. It is fully a half larger than the largest speci-
the Sierra Nevada form, and differs from it wholly in coloration.
t striking feature is the possession of a mantle or cloak of golden
covering the shoulders and upper third of the back. The hairs
fully twice the length of those on the remainder of the back and
The under parts are deep chestnut-red, while in the Sierra Ne-
ecies they are bright yellow, as described by Bachman. The

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igatus Esch.=*A. pruinosus* auct. For the change of name see Tyrrell, "*The*
ls of Canada," Proc. Canadian Inst., 3d series, vol. VI, 1888, p. 88.

feet are concolor with the under parts, and the hairs are reddish brown to the skin, there being no black basal portion, as in *flaviventer*. The whole top of the head is black or brownish black, with a more or less distinct white transverse bar between the eyes and the nose. The tail is long and broad, distichous, reddish brown above, with a black median stripe below, in sharp contrast with the brown of the sides. The whiskers are less heavy than in *flaviventer*. The species may be known by the following description:

ARCTOMYS DACOTA sp. nov.

(BLACK HILLS MARMOT.)

Type $\frac{4475}{5113}$ ♂ ad. From Custer, Black Hills, Dakota, July 21, 1888. Collected by Vernon Bailey.

Measurements.—Total length, 670^{m}; tail, 188; hind foot, 86 (taken in flesh by the collector); ear from crown, 13 (from dry skin). Weight, 7.73 kilograms (=17 lbs).

General characters.—Size large, considerably exceeding the largest individuals of *A. flaviventer* and equaling large specimens of *A. monax*. Tail long, large, and bushy, squarely truncated at the end. Hairs of the neck and shoulders very much elongated and mixed with a thick coat of woolly underfur, forming a sort of mantle.

Color.—Above, light yellowish brown, becoming grizzled on the posterior half of the back (by the admixture of black hairs having a subapical zone of white); head black, or nearly black, grizzled on the face and sides of the neck with white and reddish brown, and interrupted between the nose and eyes by a few white hairs (indicating the position of a transverse whitish bar in other specimens); end of muzzle white all round, including tip of nose and chin; under parts uniform dull rusty chestnut, including fore legs and feet all round, except that the feet and hind legs are mixed with yellowish; tail above and on the sides dull rusty chestnut, very similar to the color of the belly; tail below with a broad median band of clear black, broadening toward the end, and protruding slightly beyond the brown of the upper surface, so that it shows from above. Whiskers and superciliary bristles black.

Cranial characters.—The skull of *Arctomys dacota* differs from that of *Arctomys flaviventer* in having the nasal branches of the premaxillaries much broader throughout, the nasal bones shorter, the interorbital breadth greater, the basisphenoid fenestrated, and the basioccipital with a subcircular median fossa. The skull, as a whole, including the zygomatic arches, is much broader, shorter, and heavier than that of *A. flaviventer*, but is in no way intermediate between *flaviventer* and *monax*.

General remarks.—Another specimen, an adult female (No. $\frac{4474}{5111}$), killed at the same place July 19, 1888, measured: Total length, 62.5; tail, 165[*]; hind foot, 79; ear from crown, 12. The mantle is light golden-

ow, sharply defined from the color of the posterior part of the back,
a distinct transverse bar of yellowish-white crosses the face between
eyes and nose. Several half-grown young, taken at the same place
ng the middle and latter part of July, agree with the above in color
in the distinctness of the mantle. The mantle is less sharply de-
l in the type specimen than in any of the others. Probably this
ne in part to the condition or stage of growth of the pelage, and
be found to vary somewhat with season.

DESCRIPTION OF A NEW SPECIES OF PIKA (LAGOMYS SCHISTICEPS) FROM THE SIERRA NEVADA MOUNTAINS IN CALIFORNIA.

By Dr. C. Hart Merriam.

The "Little Chief Hare," or Rocky Mountain Pika (*Lagomys princeps*), was described by Dr. Richardson from a specimen collected in the Rocky Mountains near the south branch of the Mackenzie, considerably north of the United States boundary. He gave its distribution as "the Rocky Mountains, from latitude 52° to 60°" (Fauna Boreali-Americana, 1829, 227). It has been since ascertained to range southward along the summits of the Rocky Mountains to latitude 42°, increasing its altitude with the decrease in latitude till in Colorado it is not found below timber-line—about 11,000 feet.

As long ago as 1863 Dr. J. G. Cooper found a species of *Lagomys* near the limit of perpetual snow in the Sierra Nevada Mountains in California,* and it has been assumed that this animal is specifically identical with that from the Rocky Mountains. Comparison of specimens, however, shows the Sierra Nevada *Lagomys* to be a very distinct species, which may be easily distinguished from its Rocky Mountain congener by both external and cranial characters. Its most conspicuous external feature is the slate-gray color of its head, which circumstance has led me to bestow upon it the specific name *schisticeps*. It may be characterized as follows:

LAGOMYS SCHISTICEPS sp. nov.

Type, $\frac{4124}{5078}$ ♂ ad. From Donner, California, June 9, 1888. Charles A. Allen.

Measurements.—Total length, 188^{mm}; tail, 9.5 (taken in flesh by collector). Ears from crown, 16; hind foot, 29.5 (taken from dry skin).

Color.—Entire upper surface of head slate-gray, in striking contrast to the yellowish brown of the same parts in *L. princeps*. The slate-gray of the head extends from the nose to the nape, where it gradually shades into the grayish brown of the back; rest of upper parts strongly suffused with fulvous, which is most intense along the sides near the belly; the black-tipped hairs are not so numerous as in *L. princeps*, and are more uniformly distributed, with no tendency to form a dark patch on the lower part of the back, as is usually the case in the latter species. Belly and upper surfaces of feet whitish, washed with buff or pale fulvous, deepest on the pectoral region. Under fur slate-black; soles of hind feet dusky; of fore feet, silky yellowish white; ears, whiskers, toe-pads, and character of fur precisely as in *L. princeps*.

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* *Proc. Cal. Acad. Sci.*, III, 1863, 69; also IV, 1868, 6.

Cranial characters.—Compared with *L. princeps*, the skull of *L. schisticeps* presents several excellent specific characters. Viewed from above, the preorbital portion is shorter and more obtuse, with consequent shortening of the nasal bones. The intermastoid breadth is greater, and the posterior part of the calvarium is broader and *more obtusely rounded*. The supraoccipital takes part in the formation of the vault of the cranium, where it appears as a narrow bridge between the mastoids, with a smooth face continuous with the superior surface of the skull and nearly at right angle to its vertical plane. In the type specimen (No. 5376 ♂) this horizontal strip of the supraoccipital is broadest in the middle, where it attains a breadth of two and a half millimeters. In the seven skulls of *L. princeps* examined the supraoccipital does not appear on the superior surface of the cranium, except to take part in the formation of the lambdoidal crest, which is obsolete in *L. schisticeps*.

Viewed from beneath, the most striking difference between the two species becomes apparent, as may be seen from the accompanying figures. In *L. princeps* the palatine fossa is broadly pyriform and the anterior border of the palatal bridge which forms its base is either straight or slightly excavated (see pl. viii, fig. 6). Allen, in his diagnosis of the family *Lagomyidæ*, states that this bridge "is wholly devoid of the pointed anterior extension seen in the latter" (the Hares, *Leporidæ*). The type specimen of *Lagomys schisticeps* in this respect presents exactly the condition seen in the Hares, the anterior margin of the palatal bridge being produced forward in a sharp point, much altering the shape of the fossa of which it forms the base (see pl. viii, fig. 4). Moreover, the palatal fossa is both narrower and longer than in *L. princeps*, and the vomer projects backward a considerable distance beyond its anterior border, which is formed by the premaxillaries. The distance from the incisors to the palatal fossa is less than in *L. princeps*. Still another important difference, perhaps the most important of all, exists in the base of the skull. The basi-occipital is shorter and very much broader in *L. princeps* (pl. viii, fig. 5) than in *L. schisticeps* (pl. viii, fig. 3). In three skulls of *L. schisticeps* the average ratio of breadth to length of basi-occipital is 70; in three skulls of *L. princeps* it is 44.

Measurements of skulls of Lagomys schisticeps and L. princeps.

	Lagomys schisticeps Merriam.				
	3346♂	3347♀	3348♀	5375♀	5376♂
Basilar length (from one of the occipital condyles to posterior edge of alveola of incisor of same side)	37	......	35	......	40
Basilar length of Hensel (from inferior lip of foramen magnum to posterior edge of alveola of incisor)	34	......	33.7	......	36.8
Greatest zygomatic breadth	......	......	20.4	21	22
Greatest mastoid breadth	21	......	......	......	21.5
Interorbital constriction	......	4.8	4.5	5.3	5.2
Greatest length of nasal bones	13.2	......	13	13.4	14.3
Length of upper molar series (on alveolæ)	8	8	8.2	8.2	8.5
Incisor to molar	9.3	10.5	9.3	9.4	10
Incisor to post-palatal notch	15.8	......	14.1	14.2	15.7
Distance between alveolæ of upper molar series anteriorly	......	......	5.8	6	6
Distance between alveolæ of upper molar series posteriorly	......	......	7.7	8	7.8
Foramen magnum to post-palatal notch	18.3	......	20	......	21.2
Length of mandible (symphysis to angle)	28	......	27	28	30
Height of mandible from angle to condylar process	16	......	15.3	15.6	17
Length of under molariform series	8	8	7.8	8	8
Distance from incisor to molariform series	5.5	......	5.4	5.8	5.8

	Lagomys princeps Richardson.				
	5221♀?	5756	5758	5759♂	5760♀ im.
Basilar length (from one of the occipital condyles to posterior edge of alveola of incisor of same side)	36.7	38	41	38.7	35
Basilar length of Hensel (from inferior lip of foramen magnum to posterior edge of alveola of incisor)	33.2	34.5	37.5	35.5	31.5
Greatest zygomatic breadth	21.4	21.4	22	21.3	20.8
Greatest mastoid breadth	20.7	21	20.3	19.5	19
Interorbital constriction	5.4	5.5	4.7	5.4	5.6
Greatest length of nasal bones	13.7	14.6	16	14.9	13
Length of upper molar series (on alveolæ)	8.1	8	8.6	8.6	8
Incisor to molar	9.6	10.7	11.3	10.5	8.5
Incisor to post-palatal notch	15	16	16.6	16	14
Distance between alveolæ of upper molar series anteriorly	6.5	6	6	6	5.3
Distance between alveolæ of upper molar series posteriorly	7.5	7.8	7.5	7.4	7.7
Foramen magnum to post-palatal notch	18.7	18.7	21.4	20	17.7
Length of mandible (symphysis to angle)	27.7	28.8	29.5	28.8	26.4
Height of mandible from angle to condylar process	16.2	16.4	16.2	16.2	14.6
Length of under molariform series	8	7.8	8.4	8.2	7.8
Distance from incisor to molariform series	5.3	6.3	6.4	6	5.3

PTION OF A NEW SPERMOPHILE FROM SOUTHERN CALIFORNIA.

By Dr. C. Hart Merriam.

SPERMOPHILUS MOHAVENSIS sp. nov.

(Mojave Desert Spermophile.)

[illegible] ♂ ad. From Mojave River, California, June 29, 1886. Collected
y F. Stephens.

uremcnts (taken in flesh by collector).—Head and body, 162; tail
e, 68; hairs, 16. Hind foot 38 (measured from the dry skin after
to straighten the toes.

al characters.—Size about equal to *S. mollis;* slightly larger than
:audus; tail with hairs about half the length of head and body,
us; ears rudimentary; feet large; claws long and moderately
thumb with a large blunt claw; palms naked; soles densely
claws; pelage rather harsh.

—Above, uniform grizzled grayish brown or drab-brown; be-
ed white; eyelids white; tail above like the back, but with much
termixed, particularly in the distal two-thirds where it is fully
ck and bordered with creamy-white; below creamy-white, bor-
l around by a subterminal black band.

al and dental characters.—Compared with that of *S. tereticaudus*
l is larger, thinner, and smoother; the nasals are broader pos-
and also extend further backward, slightly overreaching the
anches of the premaxillaries, which latter are narrower poste-
an in *S. tereticaudus*, though broader than in *S. mollis;* the shelf
alate is produced backward in the median line in the form of a
nder spine instead of the blunt point of *tereticaudus.* The
f the molar series is the same as in *tereticaudus*, though the
larger—consequently the ratio of this length to the length of
l is less; the first upper premolar is smaller and shorter than
r *tereticaudus* or *mollis*—in fact it falls short of the level of the
of the molar series.

st.—So far as known the present species is confined to the arid
which the Mojave River sinks. At all events enough is known

of the mammals of the surrounding region to justify the stat
that it does not occur to the west, south, or east of the Mojave de
hence the only direction in which it may yet be found is to the
ward, in the desert region of southern Nevada.

General remarks.—The number of specimens examined is ni
cluding adults of both sexes and young. The characters are ver
stant, there being little variation either in size or color. The s
is entirly distinct from any previously described.

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DESCRIPTION OF A NEW SPERMOPHILE FROM NORTHWESTERN ARIZONA.

By Dr. C. HART MERRIAM.

SPERMOPHILUS NEGLECTUS sp. nov.

Type [illegible] ♂. Dolan's Spring, Arizona, February 9, 1889. Vernon Bailey.

Measurements (taken in flesh by collector).—Head and body, 204mm; tail vertebræ, 74; hairs, 14; hind foot, 32.

General characters.—Similar to *S. tereticaudus* but smaller, with much shorter tail and hind feet; ears reduced to a rim above, probably not more than 1mm high in the living animal; soles densely haired from heel to claw; tail vertebræ about half the length of head and body; basal third of tail terete; distal two-thirds distichous; pelage softer and longer than in *S. tereticaudus*, particularly on the sides and under parts. This may be due largely to season, as the specimens were collected in winter (February).

Color.—Above, grizzled grayish brown, resulting from the intimate and very fine admixture of white and black tipped hairs over a cinnamon ground color. The long black hairs form interrupted lines on the back as in *S. tereticaudus*, only less distinct. Under parts yellowish white; eyelids white; tail above and below concolor with the back, except that it has a subterminal black band which is continuous laterally with an indistinct subterminal border which disappears altogether a little above the middle of the tail.

General remarks.—This Spermophile is nearly related to *S. tereticaudus*, from which it may prove to be only subspecifically separable when specimens are collected from the region between Fort Yuma and Fort Mojave. At all events it is distinct enough from *S. mollis* and *S. mohavensis*.

Three specimens from the valley 1 mile west of Dolan's Spring (altitude about 3,000 feet), collected February 9, 1889, and all males, are so much alike that the only noticeable difference is in the length of the tail, which varies from 72mm to 82mm. The individual having the longer tail (No. 5263 ♂) is larger in every way, the head and body measuring 222mm, and the hind foot 34mm. A specimen from Mineral Park, Arizona (No. 5264 ♂), collected February 12, 1889, is almost an exact duplicate of the one last mentioned. Four specimens (one ♂ and three ♀) collected at Mojave, Ariz., March 11 and 12, 1889, are in the molt. The pelage is harsher in texture and redder in color.

DESCRIPTION OF A NEW SPECIES OF GROUND SQUIRREL FROM THE ARID LANDS OF THE SOUTHWEST.

By Dr. C. HART MERRIAM.

TAMIAS LEUCURUS sp nov.

The Ground Squirrels of the *Tamias harrisi* type from the region of the lower Colorado River are separable into two very distinct species, according to the color of the under side of the tail. In the form described as *harrisi* by Baird and Allen this part of the tail is white, and becomes the most conspicuous feature of the animal as it runs swiftly away with the tail cocked up over its back, after the manner of the antelope. To this circumstance, Mr. H. W. Henshaw informs me, it owes the name "Antelope Squirrel," by which it is locally known. This species is represented in my collection by specimens from southern Utah, northern Arizona, southern Nevada, southern California, and the peninsula of Lower California.

Specimens from western and southern Arizona resemble those just mentioned so closely, both in size and coloration, that it would be difficult to separate them but for the difference in the color of the under surface of the tail, which is dark iron-gray instead of white, both upper and under surfaces being colored alike. Hence the striking effect produced by the white under-tail of the Antelope Squirrel is wanting. This form is the true *harrisi* of Audubon and Bachman, as will be shown directly, though it seems to have escaped the notice of naturalists during the past thirty-five years.

Tamias harrisi (originally, and I am not sure but correctly, placed in the genus *Spermophilus*) was described by Audubon and Bachman from a single specimen presented to them by Edward Harris, esq., and supposed to have been collected in the West by J. K. Townsend during his overland journey to Oregon (Quadrupeds of North America, III, 1854, 267-269). Since, however, the route followed by Townsend was far to the northward of the known range of the species, and since the animal was not in the collection of mammals brought back by Townsend and by him placed at the disposal of Dr. Bachman for examination and description,* it seems at least possible that it was not collected by Townsend at all, but was wrongly accredited to him by some accident or trick of memory during the fourteen years intervening between his return and the publication of Audubon and Bachman's description. At all events, we know nothing of the locality whence it came. Therefore, in deciding which of the two forms must retain the name *harrisi*, the only guide is Bachman's published description and figure. Unfortunately, the under surface of the tail is not shown in the figure and is not mentioned specifically in the description. Both plate and description, however, agree in giving the tail a length [" vertebræ 3¼ in." $=82.5^{mm}$] which is considerably greater than that possessed by any of the numerous specimens examined of the white tailed form. Moreover, had the under side of the tail been white, Bachman surely would have mentioned the fact. His detailed description of the color-zones of the hairs of the tail agrees perfectly with the dark-tailed Arizona animal, and differs markedly from the usual condition of the white-tailed. The description is as follows: "The hairs of the tail are whitish at the roots, twice annulated with black, and tipped with white"—which is true of this species whether examined from above or below. In the species having the under tail white, on the other hand, the hairs of the under side of the tail are white throughout and those of the upper side are black at the roots, then white, with a single free zone of black, and tipped with white.† Hence there can be little doubt that *Tamias harrisi* really is the species with the *dark* under tail. This question decided, it remains to name and describe the white-tailed species. It may be known from the following:

TAMIAS LEUCURUS sp. nov.

(ANTELOPE SQUIRREL).

Type $\frac{1108}{1660}$ ♂ ad. San Gorgonio Pass, California, May 16, 1885. F. Stephens.

Measurements.—Head and body, 140; tail vertebræ, 69 (taken in flesh by collector). Hairs, 17; hind foot, 38; ear from crown, 4 (taken from skin).

General characters.—Size a little smaller than *T. harrisi*, with which it agrees in form and proportions, except that the tail is shorter. The tail is distichous. This species and *T. harrisi* are nearly related to the Spermophiles and differ at least subgenerically from *Tamias* proper, as pointed out by Allen (Monog. N. Am. Rodentia, 1877, 811). The soles are densely haired from heel to tubercles.

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* Concerning these specimens Dr. Bachman said: "Mr. J. K. Townsend having placed at my disposal for examination and description his valuable collection of quadrupeds obtained in his recent laborious and perilous journey over the Rocky Mountains and along the western borders of our continent, I proceed to give short descriptions of such as appear to be undescribed."—(Jour. Phil. Acad. Sci., VIII, pt. 1, 1839, 57.) No mention is made of it in this paper or in Townsend's narrative of his journey.

† In some individuals there is an (abnormal ?) elongation of the lateral hairs of the *proximal* third *of* the tail, in which case the very base of each hair is white, and there are *two black zones* as in *harrisi*.

Color.—Above, finely grizzled, the ground color varying from grayish on the anterior half of the back to pinkish vinaceous on the rump and head, and becoming salmon on the outside of the fore legs and thighs. A single white stripe on each side extends from the shoulders to the rump. Eyelids and underparts white. Tail bicolor: above, iron-gray, resulting from the fine admixture of the white and black annulation of the hairs, with an indistinct white border; below, clear white, with a subterminal black border more or less obscured by the underlying hairs, which are white throughout without annulations. On the upper side of the tail all the hairs are annulated. On the proximal half the lateral hairs are longer than elsewhere, the very base of each hair is white, and there are two annulations of black as in *harrisi*[*]; on the distal half the base of each hair is black, with but one free black annulation.

Cranial characters.—The skull of *Tamias leucurus* closely resembles that of *T. harrisi*, but differs from it in having the nasal bones much narrower posteriorly.

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[*] Whether this condition is abnormal, or due to the stage of growth of the hair, I do not know.

DESCRIPTION OF A NEW SPECIES OF FREE-TAILED BAT FROM THE DESERT REGION OF SOUTHERN CALIFORNIA.

By Dr. C. HART MERRIAM.

NYCTINOMUS FEMOROSACCUS sp. nov.

Type 2276 ♂ ad. Agua Caliente, Colorado Desert, California, March 27, 1885. Collected by F. Stephens.

Measurements (from the alcoholic specimen).—Total length, 103; head and body, 60; tail, 41; exserted part of tail, 23; head, 23; ear from crown, 14; ear from base of antitragus, 20; tragus, 1; humerus, 28; fore-arm, 47; third finger: metacarpal, 45; first phalanx, 20; second phalanx, 19; fifth finger, 44.

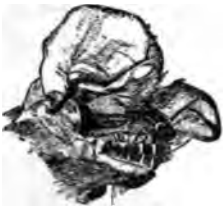

FIG. 3.—Head of Nyctinomus femorosaccus.

General characters.—Incisors $\frac{1-1}{2-2}$. Lower incisors bifid and crowded; first upper premolar small, but well developed; second very large, with a large and high antero-internal cusp. Ears thick, united by bases of inner margins 4.5^{mm} from end of nose; ear keel greatly developed, with a large lobe on its lower third; antitragus higher than long, convex anteriorly, slightly concave posteriorly, and separated by a deep notch; tragus subquadrate, hidden behind the large antitragus, its outer angle projecting upward in the form of a small pointed lobule; upper margin of ear conch with two minute horny projections, not symmetrical on the two sides. Tail more than half exserted. Gular sac present (opening on right side of median line). There is a curious fold of membrane stretching from the inner third of the femur to the middle of the tibia, forming a deep pocket between it and the interfemoral membrane. The wing membrane is attached to the leg at the same point (immediately below the middle of the tibia), so that there are three folds of membrane here. The fur extends out on the wing membrane, above and beneath, as far as a line drawn from the middle of the humerus to the junction of the middle and outer thirds of the femur. *Color, dull brown.*

RIPTION OF A NEW SPECIES OF FREE-TAILED BAT FROM THE LOWER COLORADO RIVER IN ARIZONA.

By Dr. C. HART MERRIAM.

NYCTINOMUS MOHAVENSIS sp. nov.

ype 5418 ♂ ad. Fort Mojave, Arizona, March 8, 1889. Vernon Bailey.

asurements (from alcoholic specimen).—Total length, 94; head and , 56; head, 19.5; ear from base of antitragus, 18; ear from crown, tragus, 2; tail to end of vertebræ, 34; exserted part of tail, 13.5; erus, 24; fore-arm, 44; third finger: metacarpal, 43; first phalanx, econd phalanx, 16; fifth finger, 42.

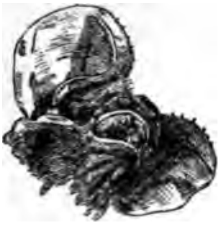

FIG. 4.—Head of Nyctinomus mohavensis.

eral characters.—Incisors $\frac{1-1}{2-2}$. Lower incisors not distinctly bifid; upper premolar minute; second large, with a well developed an· internal cusp. Ears thinner and more translucent than in *N. femo· cus*, united by bases of inner margins; posterior surface marked bout five indistinct transverse wrinkles; ear keel small, without a nct lobe on its inner third; anterior convexity of auricle with six y spines; antitragus very low and flat, much longer than high, iding tragus; tragus rather large, subquadrate. Lips deeply and uely wrinkled. Wings from lower third of tibia. Fur above ex· ing from middle of humerus to distal third of femur; below from lle of humerus to knee. Tail less than half exserted. No gular Color above, sooty; paler below.

DESCRIPTION OF A NEW GENUS (PHENACOMYS) AND FOUR NEW SPECIES OF ARVICOLINÆ.

By Dr. C. HART MERRIAM.

The genus which is the subject of the present paper is of unusual interest, inasmuch as it is the most central or generalized form yet discovered in the Arvicoline series. It not only combines in a remarkable manner the characters of the Arvicoline genera *Myodes*, *Synaptomys*, *Cuniculus*, *Arvicola*, and *Evotomys*, but is near if not in the direct line of descent from the Murine series.

It was first brought to my notice by Dr. George M. Dawson, Assistant Director of the Geological and Natural History Survey of Canada, who sent me for identification a specimen collected by him near Kamloops, British Columbia, October 2, 1888. Dr. Dawson had no facilities for the preparation of this kind of material, hence the specimen reached me in the form of a rough skin, turned inside out to dry, with the broken skull attached. Fortunately the feet, tail, and teeth were preserved—enough to furnish the most important characters. So far as external features are concerned—size, proportions, and coloration—there is nothing to indicate that the animal might not be a pale individual of the common eastern meadow mouse or vole (*Arvicola riparius*), but the skull and teeth differ essentially from those of any previously known genus. All of the molars in both jaws are rooted, each having two true divergent roots, instead of growing from a persistent pulp, as in *Arvicola*. The crowns of the upper molars, in the number and arrangement of their triangles, resemble those of the Mississippi Valley voles of the subgenus *Pedomys*, while they agree with *Evotomys* in the large size of the dentine islands and the crowding of the teeth. The crowns of the lower molars not only differ from those of any section of the genus *Arvicola*, but resemble in certain respects the corresponding teeth of the singular genera *Myodes*, *Synaptomys*, *Cuniculus*, and *Evotomys*.

In studying the affinities of this remarkable animal I examined the entire series of skulls of the subfamily *Arvicolinæ* in the U. S. National Museum, as well as those in my own collection (several hundred in number), and also a large number of alcoholics. The result of this investigation was the discovery of five additional specimens of the new genus. Two of these are broken skulls labeled in Dr. Coues's handwriting as having been collected by himself at Groswater Bay, Labrador, in 1860, but not mentioned in his published writings on the *Muridæ*. The remaining three (all new species) were alcoholics, one collected by Napoleon A. Comeau at Godbout, on the north shore of the St. Lawrence, near the point where the river widens into the gulf; the two others collected by Lucien M. Turner, near Ft. Chimo, Ungava Bay. Hence the range of the new genus is demonstrated to extend across the continent from Labrador to British Columbia. Probably it will be found to invade northern Idaho, Washington, and perhaps Montana also. The results of this study will be found in the following pages.

PHENACOMYS* genus nov.

Type *Phenacomys intermedius* sp. nov., from Kamloops, British Columbia.

DIAGNOSIS.

Brain case subquadrate, with prominent supraorbital ridges bordering a median frontal sulcus; postorbital process of squamosal peglike; interparietal rather large; zygomatic arches lowest opposite first molar, and expanded vertically into a broad lamina; shelf of palate broadly emarginate posteriorly, without the "step" of *Arvicola*; ascending ramus of mandible long and slender, slightly higher than coronoid process; root of lower incisor ending at level of alveola of last molar; molars rooted, each having two true divergent roots; crowns large, crowded, with broadly rounded prisms; pattern of upper molar series and arrangement of prisms as in *Arvicola* (section *Pedomys*); anterior face of second and third upper molars concave, the anterior loop pyriform, bulging on the inner side; lower molars with line of infolding of enamel near the outer side; last lower molar very large, as broad or nearly as broad anteriorly as posteriorly, and consisting of three elongated transverse loops joined along the outer side of the tooth, without any distinct external loop or triangle.

GENERAL CHARACTERS AND COMPARISONS.

External characters.—Forefoot 5-tuberculate; hindfoot 6-tuberculate, the outer tubercle large and prominent (see pl. II, figs. 4 and 5 *b*) [in *Arvicola* it is nearly obsolete]; posterior half of sole well haired; ears reaching or slightly overtopping the tips of the surrounding hairs; whiskers reaching the shoulders, larger and stiffer than in *Arvicola*; pelage full and soft.

Cranial characters.—Viewed from above, the brain case is subquadrate, marked by prominent lateral ridges, as in *Synaptomys* and *Cuni-*

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* Phenacomys, from φέναξ = *a cheat, an imposter*; and μυς = *a mouse*, in reference *to the circumstance that the external appearance of the animal gives no clue to its real affinities.*

culus (pl. II, fig. 1; pl. III, fig. 9). There is a distinct supraorbital ridge bordering a median longitudinal frontal sulcus. It rises from the anterior border of the orbit and passes backward, following the outline of the calvarium to the lateral border of the interparietal, where it bends downward and becomes continuous with the vertical crest of the squamosal, which ends at the upper margin of the audital opening. In addition to the deep frontal sulcus there is on each side of the brain-case a shallow lateral sulcus between the ridge just described and a horizontal ridge of the squamosal, which is formed by the extension forwards and backwards of the posterior root of the zygoma. At the point of junction of the orbital and temporal fossæ this ridge gives off a very distinct postorbital process (*squamosal*, not frontal), which, with the laminar expansion of the zygoma below serves to sharply differentiate the orbit from the temporal fossa.[*] Furthermore, the temporal fossa is much reduced in breadth by the lateral encroachment of the brain-case, which is abruptly truncated in front of the postorbital process. The antero-posterior diameter of the interparietal is much greater than in *Arvicola*, and its transverse diameter less. In this respect it approaches *Synaptomys* and *Myodes*. In *Phenacomys celatus*, *P. ungava*, and *P. latimanus* the interparietal is pentagonal, and its posterior border is nearly straight. The nasal bones are truncated posteriorly a little in front of the ends of the nasal branches of the premaxillaries. The rostrum is not shortened or strongly deflexed as it is in the Lemmings, but more nearly agrees with its normal condition in *Arvicola*.

The zygomatic process of the maxillary bends down so abruptly that the lowest part of the zygomatic arch is opposite the first molar, as in *Myodes* (pl. II, fig. 3). In *Arvicola* the slope is more gradual, and the lowest part of the arch is opposite the last molar. The middle portion of the zygoma is expanded into a large lamina or plate, which consists of the expanded anterior end of the jugal or malar bone and the posterior portion of the zygomatic process of the maxillary. This plate slopes obliquely upward, as in *Myodes* and *Synaptomys*.

Viewed from below, several characters of importance become apparent. The shelf of the palate is broadly emarginate posteriorly, with a median azygos projection. The pterygoid fossa is much broader anteriorly than in *Myodes*, and the "step" at the back of the palate is less apparent on the sides, and is altogether wanting in the median line (pl. II, fig. 2). In this respect *Phenacomys* presents a condition intermediate between *Evotomys* and *Arvicola*, though resembling the former more than the latter. It resembles *Evotomys* further in the breadth and flatness of the palate and in the shape and relative size of the audital bullæ. The latter, while conforming to the general *Arvicoline* pattern, are somewhat suborbicular instead of subfusiform. In this particular the departure from *Synaptomys* and *Myodes* is as marked as that from *Arvicola*. The basisphenoid is essentially as in *Arvicola*—it is not cut away laterally so much as in *Synaptomys* and *Myodes*.

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[*] In *Myodes* and *Synaptomys* the horizontal ridge of the squamosal forms a projecting shelf, overhanging the temporal fossa, and rounded off anteriorly. In *Phenacomys* and *Cuniculus* this ridge is not developed into a projecting shelf, but terminates anteriorly in a distinct peg-like process.

The ascending ramus of the under jaw is long, and the articular facet is slightly above the level of the coronoid process (as in *Evotomys* and *Cuniculus*), which is sharp pointed and bent back at the tip (pl. III, fig. 9). The hamular process of the angle is rather large and curves slightly outward as well as upward. Its postero-inferior border is obliquely flattened, but not to the extent seen in *Synaptomys* and *Myodes*. The root of the lower incisor ends posteriorly at the level of the alveola of the last molar, and a little outside and behind it, as in *Evotomys*. In *Arvicola* it passes back into the ascending ramus of the jaw as far as a point above and behind the dental foramen, this point being, as a rule, about two-thirds the distance from the crown of the last molar to the articular condyle. In *Synaptomys* and *Myodes* it ends at a point opposite and a little inside of the last molar. Hence in the posterior extension of the under incisor *Phenacomys* is intermediate between the Lemmings and the true Field Mice.

When the skull is allowed to rest on the upper molar series a perpendicular let fall from the end of the nasals passes in front of the arc of the incisors, as in *Evotomys* and *Synaptomys* (pl. II, fig. 3).

Dental characters.—*Phenacomys* has genuine rooted molars (pl. III, fig. 6), not half-rooted molars like those of *Evotomys*, which grow from persistent pulps. In this respect it differs from all known members of the sub-family *Arvicolinæ*, and approaches the typical condition of the *Muridæ*. Each tooth in both upper and lower jaws has two distinct roots, which are long, divergent, and closed at the bottom, as in all truly-rooted teeth. The crowns of the teeth are large and crowded, with broadly rounded loops inclosing dentine islands of much larger size than in *Arvicola*, and somewhat larger even than in *Evotomys*, with correspondingly smaller interspaces or re-entrant angles (pl. VI). The dentine is umber-brown instead of white, thus emphasizing the peculiar appearance of the tooth-row as a whole.

Upper molar series.—The upper molars resemble those of *Arvicola* (section *Pedomys*) in the general pattern, number, and arrangement of the prisms, but the crowding of the teeth produces a depression on the anterior face of the first loop of the second and third molars at the point where the preceding tooth presses against it, and a resultant bulge just inside of this point, giving the loop a pyriform shape, with an anterior concavity (pl. VI, fig. 1), as sometimes seen in *Evotomys*. In *Arvicola* this loop is always strongly convex anteriorly. The details of the crowns are as follows: First upper molar with a broadly rounded anterior transverse loop, two external and two internal rounded triangles; second upper molar with an anterior pyriform transverse loop, *one large internal* and two smaller external rounded triangles; third

molar with an anterior pyriform transverse loop, one external
e internal closed triangle, and a posterior trefoil (pl. IV, fig.
Sometimes the outer loop of the trefoil is closed, giving the
wo external closed triangles and a postero-internal loop (pl. IV,
).

r molar series.—Line of infolding of enamel near outer side of
ow. First lower molar with a posterior transverse loop, four
elongated internal triangles or digitations, of which at least two
npletely closed, an anterior loop of variable shape, and three
xternal triangles, of which at least one is completely closed.
lower molar with a posterior transverse loop, two greatly
ed internal triangles, of which one or both are closed, and two
xternal rounded triangles, one or both of which are closed.
ower molar much larger than in *Arvicola*, as broad or nearly as
anteriorly as posteriorly, with three greatly elongated internal
s in *Synaptomys* and *Myodes*, but without external triangle, the
ide being plane or having at most only two convexities, which
ond with the middle and last loops, respectively. By refer-
the accompanying figures it will be seen that the last lower

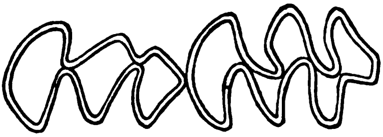

FIG. 5.—Last lower molars of Arvicola.

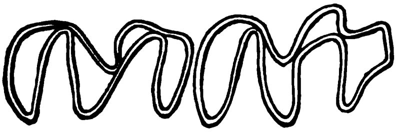

FIG. 6.—Last lower molars of Synaptomys.

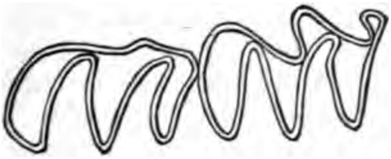

FIG. 7.—Last lower molars of Phenacomys.

of *Phenacomys* differs widely from that of *Arvicola*, but closely
les that of *Myodes* and *Synaptomys*, the principal difference being
sence in the last-mentioned genera of a distinct loop and cor-
ding re-entrant angle on the outer side of the tooth. The deep-
of the externo-lateral sulcus in *Phenacomys* would produce almost
ly the condition this tooth presents in *Synaptomys*. In all the
s of the genus *Arvicola* the last lower molar is much broader
rly than anteriorly, while in *Evotomys* the reverse is true, it

being broadest anteriorly. In all the lower molars of *Phenacomys* the posterior loop is rounded off externally, as in *Synaptomys* and *Myodes*, instead of forming a prominent angular projection as it does in *Arvicola* and *Evotomys* (see cuts on preceding page).

PHENACOMYS INTERMEDIUS sp. nov.

(Plate IV, fig. 11; pl. VI; pl. VII.)

Type No. 780, immature. Museum of the Geol. and Nat. Hist. Survey of Canada. From Kamloops, British Columbia,* October 2, 1888. Dr. Geo. M. Dawson.

Measurements (from dry skin).—Total length about 118; head and body, 90; tail vertebræ, 28; hairs, 2; hind foot, 18; ears from crown, 8; from anterior root, 13.

General characters.—Size rather small; tail slender, cylindrical; ears moderate, thin, protruding slightly beyond fur, well haired on both sides; roots rather near together; antitragus small, about as high as long; hind foot more slender than in *P. celatus*; whiskers long and stiff; pelage deep, full, and soft.

Color.—Above, grizzled grayish brown, paler than in *Arvicola riparius*; black-tipped hairs most abundant posteriorly, with no tendency to collect into a median darker area; under parts white, the basal plumbeous portion showing through; tail bicolor, nearly black above; fore feet light; hind feet dark, darkest on the ankle and outer side of foot. There is a strip of whitish hair on the soles.

Cranial characters.—Unfortunately the skull is badly broken, and the occipital and basal portions are absent. Enough remains, however, to show that the brain-case is broad and flat, much like that of *Chilotus*. The specimen was young, though probably full grown, and the skull differs from those of the other species here described in the usual way in which skulls of young *Arvicolinæ* differ from those of adults. It is lower and more evenly rounded, with broader interorbital and parietal regions. In fact, the breadth of the brain-case is considerably greater, both actually and in relation to the zygomatic breadth. This difference may be in part specific. There is no trace of the superciliary ridges which are so conspicuous in the adults, and but a faint indication of the lateral muscular impressions. The vertical lamellæ of the zygomatic arches are less developed, the incisive foramina are smaller, and the upper incisors are much shorter than in the other species.

Dental characters.—Upper incisiors marked with an indistinct groove near the outer side. Upper molars with all the loops and triangles closed (pl. VI, fig. 1). Last upper molar with an anterior pyriform transverse loop, two small external triangles, one large, transversely elongated internal triangle and a postero-internal loop, making in all three angular projections and two re entrant angles on each side. The ratios of the first, second, and third upper molars to the length of the ıpper molar series are, respectively, 40, 29, and 31. Front lower molar pl. VI, fig. 2, and pl. IV, fig. 11 *b*) with an anterior transverse loop, ı posterior transverse loop, four internal triangles, and three external riangles, making eleven projections, six of which are on the inner and ve on the outer side of the tooth; three triangles on each side are entirely closed, and the fourth inner triangle is nearly closed; anterior oop flattened from before backward, inner half nearly transverse, outer alf bent obliquely backward, as sometimes seen in *Cuniculus*. Second ower molar with a posterior transverse loop, two small, rounded, external losed triangles, and two large elongated, subequal internal closed loops r triangles, the posterior loop abruptly rounded off externally as in *ynaptomys*. Last lower molar large, about as broad anteriorly as posteiorly. It consists of three vertical prisms set side by side and connected t their bases along the outer face of the tooth. The line of enamelolds is thus brought in contact with the outer side of the tooth, there eing no outer angles at all; in fact the outer side has a plane, nearly at surface, marked only by a slight ridge and compensating groove opposite the middle triangle of the inner side. Therefore, the crown of the st lower molar presents the appearance of three long lobes directed ward and slightly backward, the middle one connected with the lateral n each side by a narrow isthmus at the base. The most anterior of hese three divisions is about as long as the second and third, though he latter are much broader. The ratios of the first, second, and third ower molars to the length of the lower molar series are, respectively, 9.3, 27 7, and 22.8. The length of the upper molar series, measured on he alveolæ, is 6.1; on the crowns 5.7. The corresponding measureents of the lower molar series are 5.9 and 5.5.

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* *The exact locality*, Dr. Dawson writes me, is a basaltic plateau about 20 miles *NNW of Kamloops*, at an altitude of 5,500 feet.

PHENACOMYS CELATUS sp. nov.

(Plate II, figs. 1-3; pl. III, figs. 6 and 7; pl. IV, fig. 13.)

Type No. [illegible] ♂ **ad.** **Godbout, P. Q., Canada, June 10, 1886. N. A. Comeau.**

Measurements (from alcoholic specimen before skinning).—Total length, about 130; tail vertebræ, 32; hairs, 2.5; hind foot, 17.5.

General characters.—Size rather small, about equal to *P. intermedius*; feet broader than in *intermedius*; fore foot 5-tuberculate; hind foot 6-tuberculate, tubercles all well developed; thumb rudimentary, armed with a blunt nail; tail slender, cylindrical, not particularly short (about one-third as long as head and body); whiskers long and conspicuous; ears defective, but thicker than in *intermedius*, and hardly appearing above fur, not so hairy as in *ungava*; antitragus small.

Color.—Above, brown with a tawny cast, which may be the result of immersion in wood alcohol, out of which it was skinned; below, whitish, the basal portion (about two thirds) dark plumbeous. Tail bicolor, but without line of demarkation; darkest above, near the tip. Fore feet and wrists whitish all round; hind feet and ankles whitish, suffused with pale fulvous on the upper side.

Cranial and dental characters.—Interparietal much larger than in *P. latimanus* and *ungava*, with antero-posterior diameter much greater (pl. II, fig. 1). First lower molar with a posterior transverse loop, four internal triangles of which two are closed, three external triangles of which one is completely closed, and a broadly open anterior loop directed forward and slightly outward; in all, five angular projections and four deep re-entrant angles on each side. Second lower molar with anterior triangles communicating. Third lower molar with a marked convexity followed by a distinct notch opposite the long middle lobe of the inner side (pl. IV, fig. 13). The length of the upper molar series, measured on the alveolæ, is 5.9; on the crowns, 5.5. The corresponding measurements of the lower molar series are 5.6 and 5.5 respectively.

General remarks.—In the National Museum collection there are the remains of two broken skulls of *Phenacomys* labeled "Groswater Bay, Labrador, Elliott Coues," of which I can find no mention in Dr. Coues's writings. They have the appearance of skulls found in the pellets of hawks and owls. One of them (No. 4218) is very young; the other (No. 4217) is older and larger, with correspondingly heavier processes and ridges than any of the specimens here described. I have provisionally referred it to *P. celatus*, because it has the same squarish interparietal, and essentially the same tooth pattern (see pl. III, figs. 6 and 7).

PHENACOMYS LATIMANUS sp. nov.

(Plate II, fig. 5; pl. IV, fig. 12.)

Type No. $\frac{4484}{6139}$ ♂ yg. ad. Fort Chimo, Ungava, Hudson Bay. Feb. 4, 1883. Lucien M. Turner.

Measurements (from alcoholic before skinning).—Total length, 116; head and body, 90; tail vertebræ, 28; hairs, 4; hind foot, 18; ear from crown, 5.5; from anterior root, 11. Additional measurements: Tip of nose to eye (inner canthus), 12; to center of pupil, 13; to meatus, 22; to occiput, 27; to tip of ear, 31; length of manus, 11; breadth of manus, 5; breadth of pes, 5; fore leg, 25.

General characters.—Size rather small; tail short, cylindrical; fore feet broad, as in the Lemmings (pl. II, fig. 5 *a*); whiskers not so long and stiff as in the other species; ears defective, but evidently peculiar, apparently very narrow and thin.

Color.—Above, dull rusty-brown, reddest about the eyes and nose (which may be due to alcoholic staining); below, whitish, the basal portion of the fur dark plumbeous. Tail sharply bicolor, brown above and white beneath, the latter occupying considerably more than half the circumference of the tail.

Dental characters.—First lower molar with a posterior transverse loop, four internal triangles of which three are closed, three external triangles of which two are closed, and an anterior loop directed inward. Second lower molar with anterior triangles communicating (pl. IV, fig. 12).

General remarks.—Mr. Turner writes me that this specimen was found dead in the path, and that the Indians believe that the species always dies on coming in contact with human foot-prints.

PHENACOMYS UNGAVA sp. nov.

(Plate II, fig. 4; pl. III, figs. 8 and 9.)

Type No. [illegible] ♂ ad. Fort Chimo, Ungava, Hudson Bay Territory. Spring of 1884. Lucien M. Turner.

Measurements (from alcoholic before skinning).—Total length, 138; head and body, 104; tail vertebræ, 31; hairs, 3.5; hind foot, 19; ear from crown, 7; ear from anterior root, 12. Additional measurements: Tip of nose to eye (inner canthus), 12; to center of pupil, 14; to meatus, 24; to occiput, 28.

General characters.—Size, largest of the four species herein described; tail moderately short, slender, cylindrical; ears appearing above fur, densely haired inside and on the margin outside; hind feet longer and more slender than in *P. celatus*; whiskers long and stiff.

Color.—Above, rusty-brown, reddest on the nose; below, whitish, the basal portion of the fur dark plumbeus.

Dental characters.—First lower molar with a posterior transverse loop, four internal triangles of which three are closed, three external triangles of which two are closed, and an anterior loop which forms a projection on the inner side. Second lower molar with the anterior triangles broadly communicating (pl. III, fig. 8).

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PLATE I.

Figs. 1, 2, 3, 4, and 5, *Onychomys leucogaster*, ♂ young. (Skull No. 4422.) Fort Buford Dakota.

1. Skull from above, and left under jaw from outside (× 2).
2. Crowns of left upper molars from below (× 10).
3. Crowns of left lower molars from above (× 10).
4. Crowns of right upper molars from the side (× 10).
5. Crowns of right lower molars from the side (× 10).

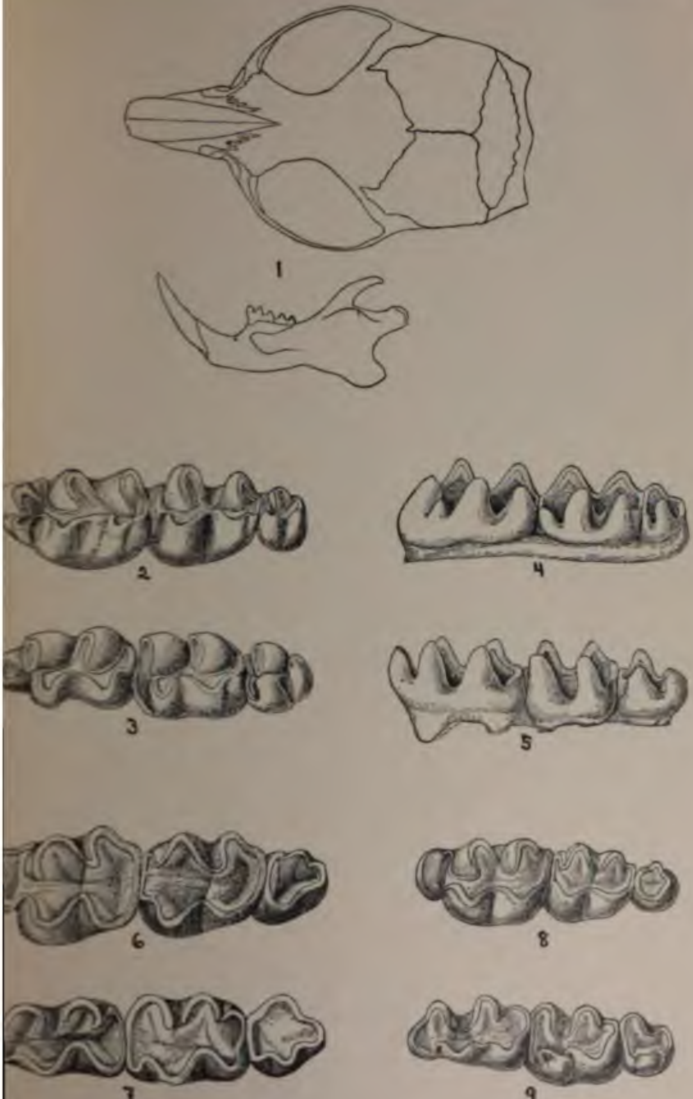
Figs. 6 and 7, *Onychomys leucogaster*, ♀ ad. (No. 5012). Valentine, Nebraska.

6. Crowns of left upper molars from below (× 10).
7. Crowns of left lower molars from above (× 10).

Figs. 8 and 9, *Onychomys longicaudus*, ♂ ad. (No. 5896). St. George, Utah.

8. Crowns of left upper molars from below (× 10).
9. Crowns of left lower molars from above (× 10).

PLATE I.



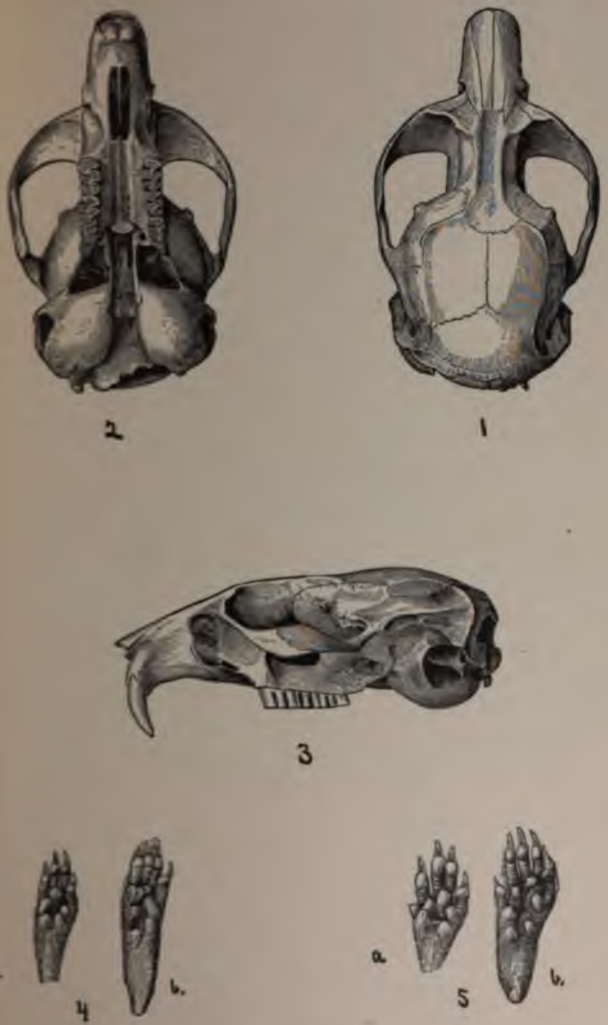
1–5. *Onychomys leucogaster*, ♂ young.
6, 7. *Onychomys leucogaster*, ♀ adult.
8, 9. *Onychomys longicaudus*, ♂ adult.

PLATE II.

1–3. *Phenacomys celatus*, ♂ ad. (No. 5988.) Godbout, P. Q., Canada. *Type.*
  1. Skull from above (× 2).
  2. Skull from below (× 2).
  3. Skull from the side (× 2).

4. *Phenacomys ungava*, ♂ ad. (No. $\frac{4468}{6188}$.) Ungava. *Type.*
  a. Left forefoot.
  b. Left hind foot (× about 1¼; drawn from alcoholic specimen).

5. *Phenacomys latimanus*, ♂ yg. ad. (No. $\frac{4484}{6159}$.) Ungava. *Type.*
  a. Left forefoot.
  b. Left hind foot (× about 1¼; drawn from alcoholic specimen).



1-3. *Phenacomys celatus*, ♂ adult.
4. *Phenacomys ungava*, ♂ adult.
5. *Phenacomys latimanus*, ♂ young adult.

PLATE III.

6 and 7. ***Phenacomys celatus*, ad.** (No. 4217.) Groswater Bay, Labrador.

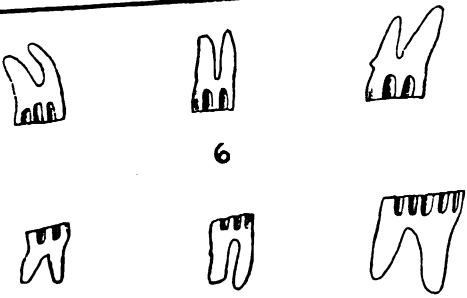
6. Molar teeth in profile (× about 4); (*a*) upper series; (*b*) lower series.
7. Crowns of molar teeth (× about 10); (*a*) upper series; (*b*) lower series.

8 and 9. ***Phenacomys ungava*, ♂ ad.** (No. 6155.) Ungava. *Type.*

8. Crowns of molar teeth (× about 10); (*a*) upper series; (*b*) lower series.
9. (*a*) Skull from above; (*b*) under jaw from left side (× 2).

10. ***Arvicola riparius*, ad.** Washington, D. C. First lower molar for comparison with corresponding tooth in *Phenacomys* (fig. 6*b*); (× about 4).

PLATE III.



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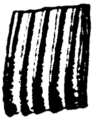

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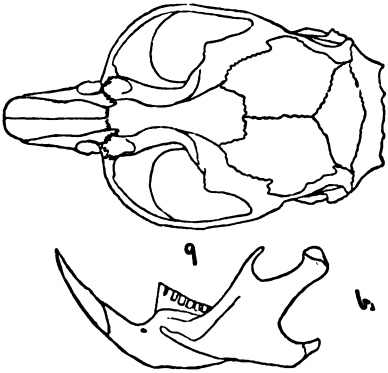

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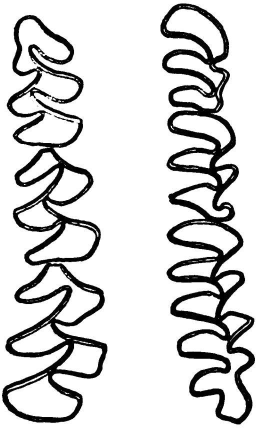

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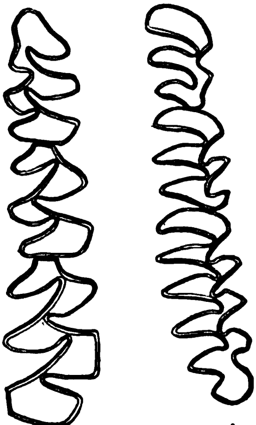

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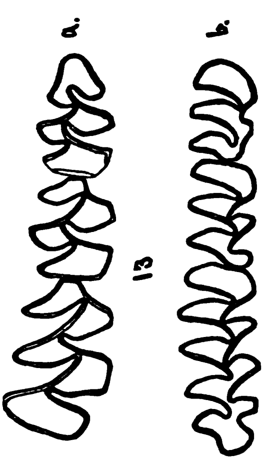
6, 7. *Phenacomys celatus*, adult.
8, 9. *Phenacomys ungava*, ♂ adult.
10. *Arvicola riparius*, adult.

PLATE IV.

11. *Phenacomys intermedius*, young. Kamloops, British Columbia. *Type.*
    a = upper molar series; *b* = lower molar series (× 10).
12. *Phenacomys latimanus*, ♂ young ad. (6159.) Ungava. *Type.*
    a = upper molar series; *b* = lower molar series (× 10).
13. *Phenacomys celatus*, ♂ ad. (5988.) Godbout, P. Q., Canada. *Type.*
    a = upper molar series; *b* = lower molar series (× 10).
14. *Arvicola austerus*, ♀ ad. (1620.) Knoxville, Iowa.
    a = upper molar series; *b* = lower molar series (× 10).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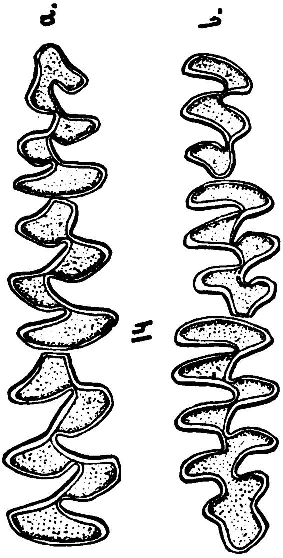
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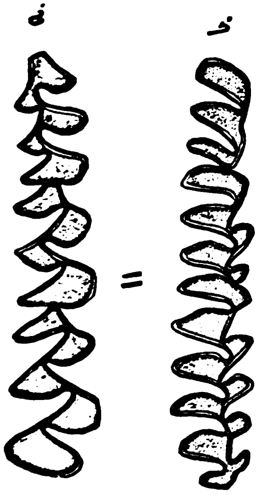
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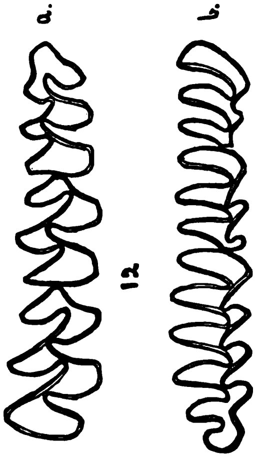
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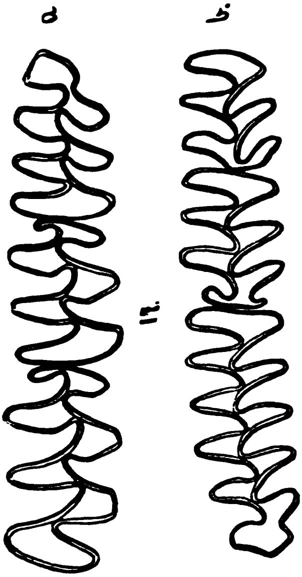
11. *Phenacomys intermedius*, young.
12. *Phenacomys latimanus*, ♂ young adult.
13. *Phenacomys celatus*, ♂ adult.
14. *Arvicola austerus*, ♀ adult.

PLATE V.

15. ***Evotomys gapperi***, ♂ ad. (1956 U. S. N. M.) Lake Superior.
a = upper molar series; *b* = lower molar series (× 10).
16. ***Synaptomys cooperi***, yg. ad. (3230.) *Type.*
a = upper molar series; *b* = lower molar series (× 10).
17. ***Cuniculus***, ♀ ad. (6160.) Fort Chimo, Ungava.
a = upper molar series; *b* = lower molar series (× 10).
18. ***Myodes***, ♀ ad. (6166.) Point Barrow, Alaska.
a = upper molar series; *b* = lower molar series (× 10).

PLATE V.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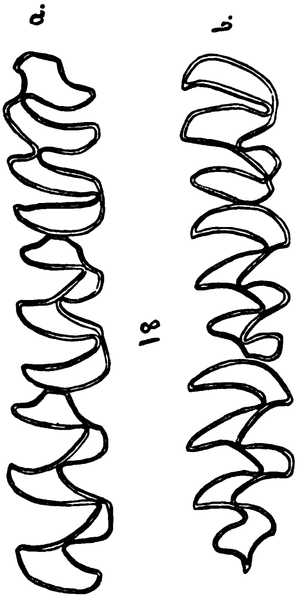
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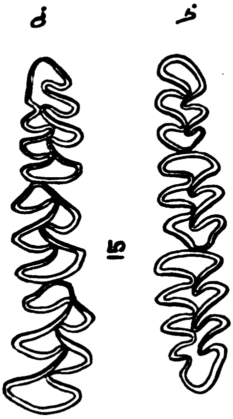
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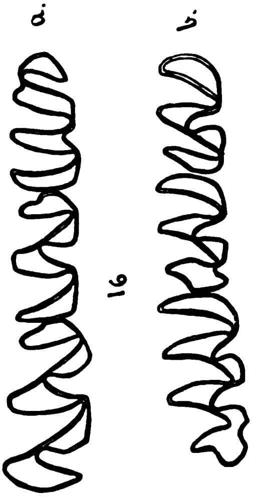
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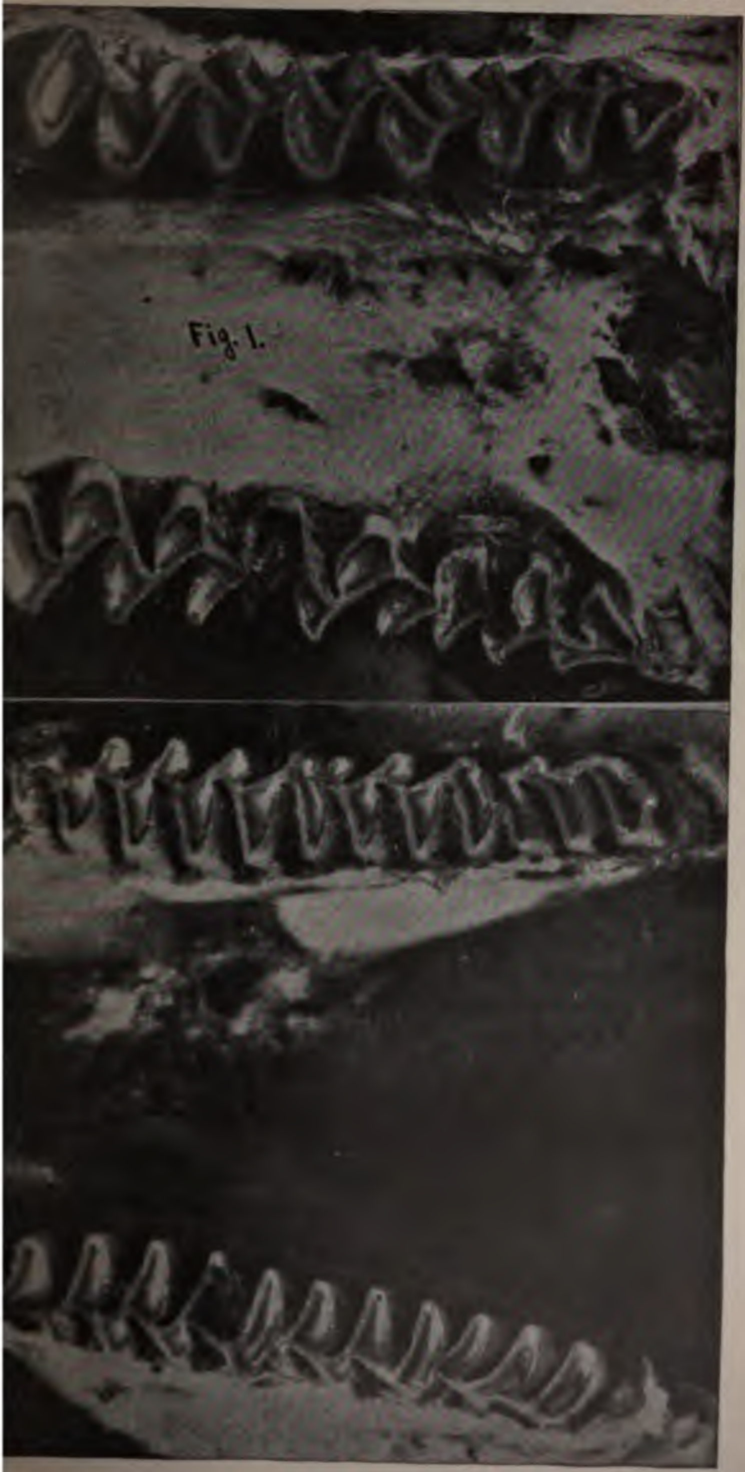
15. ***Evotomys gapperi***, ♂ adult.
16. ***Synaptomys cooperi***, young adult.
17. ***Cuniculus***, ♀ adult.
18. ***Myodes***, ♀ adult.

PLATE VI.

Phenacomys intermedius, young. (No. 780, Mus. Geol. and Nat. Hist. Surv., C
Kamloops, British Columbia. *Type*.

Fig. 1. Upper molar series, *in situ* (from a photograph. × 15).
Fig. 2. Lower molar series, *in situ* (from a photograph. × 15).



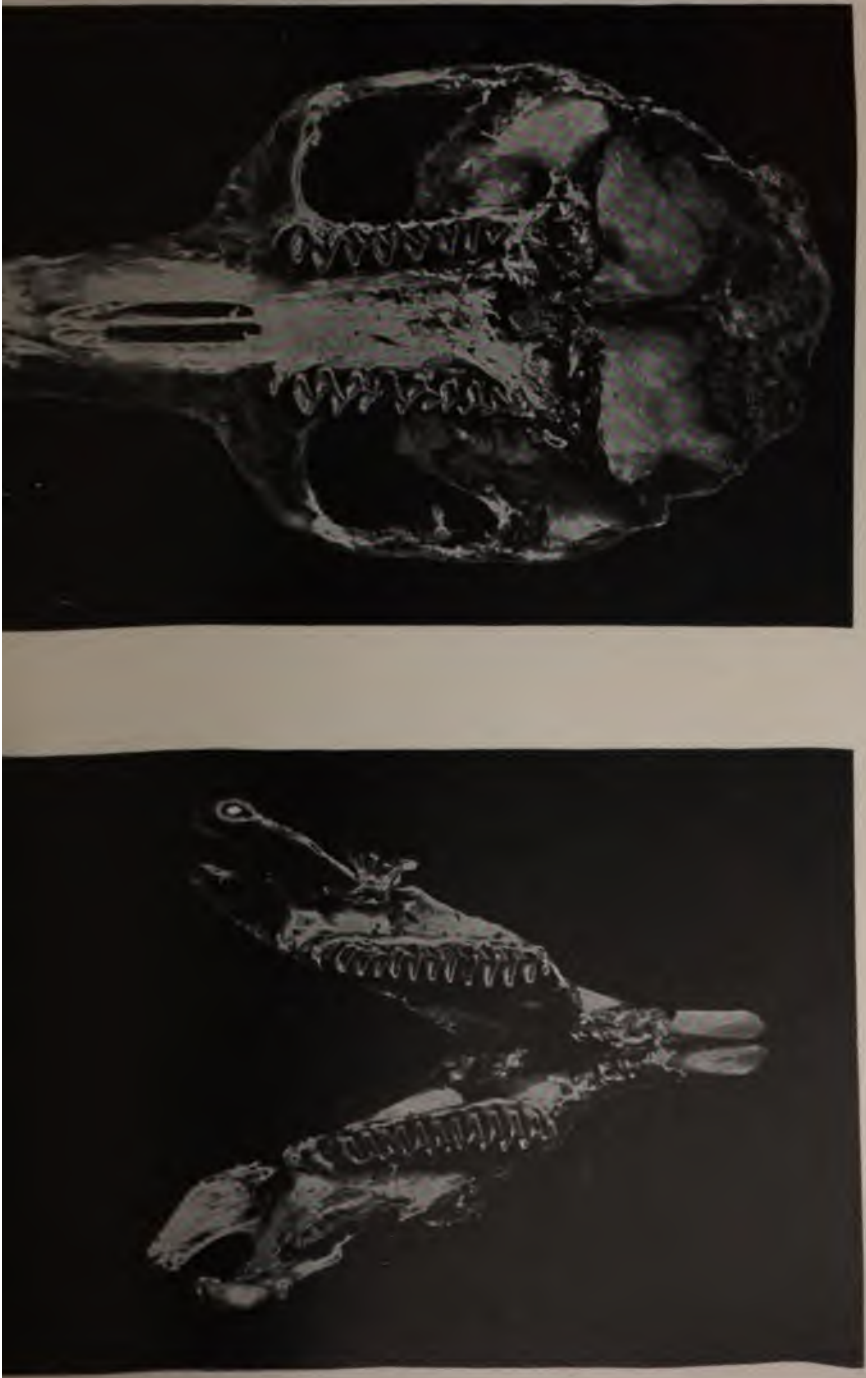
PHENACOMYS INTERMEDIUS, young.

PLATE VII.

Phenacomys intermedius, young. (No. 780, Mus. Geol. and Nat. Hist. Surv., Canada.) Kamloops, British Columbia. *Type.*

Fig. 1. Skull from below, showing teeth and the remains of the skull (from a photograph. × 5).

Fig. 2. Under jaw from above (from a photograph. × 5).



PHENACOMYS INTERMEDIUS. (Type.)

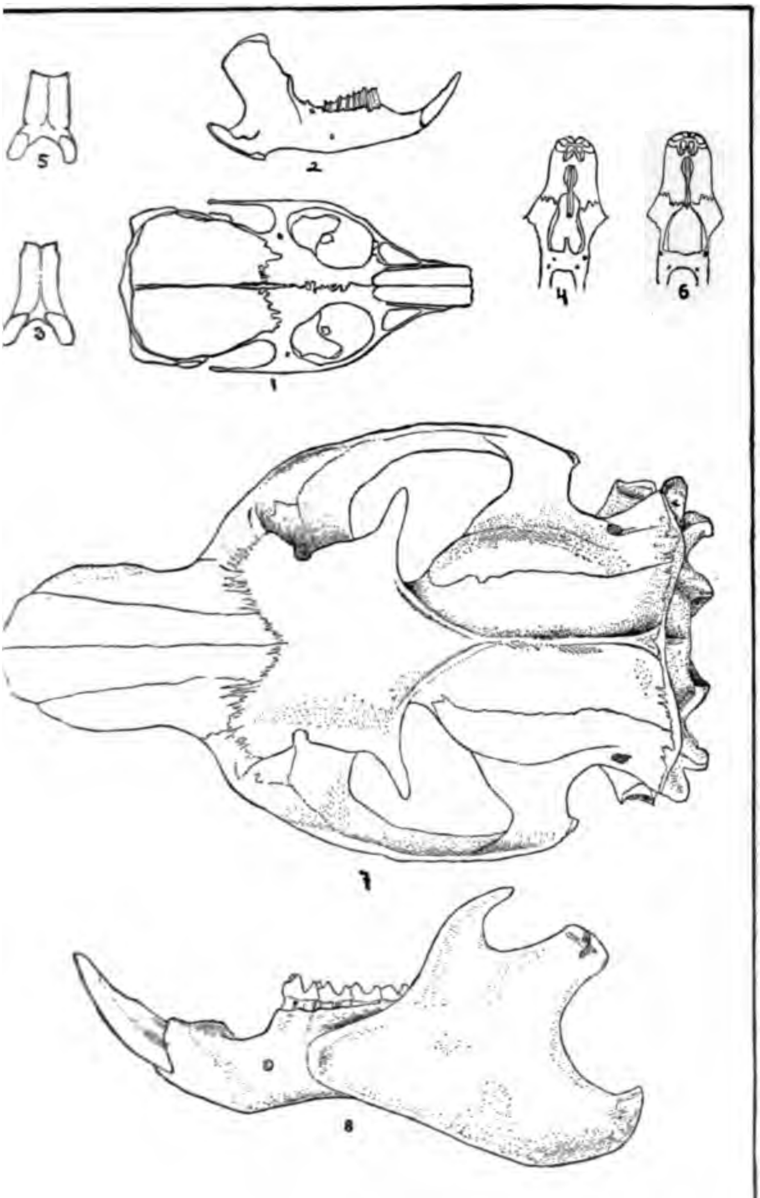
PLATE VIII.

(All natural size.)

1–4. *Lagomys schisticeps*, ♂ ad. (No. 5376.) Donner, California. *Type*.
   1. Skull from above.
   2. Under jaw from the outside.
   3. Basioccipital from below.
   4. Palatine fossa.

5 and 6. *Lagomys princeps*. Boulder County, Colorado.
   5. Basioccipital.
   6. Palatine fossa.

7 and 8. *Arctomys dacota*, ♂ ad. (No. 5113.) Black Hills, Dakota. *Type*.
   7. Skull from above.
   8. Under jaw from the outside.



1–4. *Lagomys schisticeps*, ♂ adult.
5–6. *Lagomys princeps*, adult.
7–8. *Arctomys dacota*, ♂ adult.

J O Snyder

. S. DEPARTMENT OF AGRICULTURE

DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 3

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

[Actual date of publication, September 11, 1890]

Results of a Biological Survey of the San Francisco Mountain Region and Desert of the Little Colorado, Arizona

1. General Results, with special reference to the geographical and vertical distribution of species
2. Grand Cañon of the Colorado
3. Annotated List of Mammals, with descriptions of new species
4. Annotated List of Birds

By Dr. C. Hart Merriam

5. Annotated List of Reptiles and Batrachians, with descriptions of new species

By Dr. Leonhard Stejneger

WASHINGTON
GOVERNMENT PRINTING OFFICE
1890

MEASUREMENTS.

All measurements of specimens are in millimeters.

All MAMMALS collected by Field Agents of the Division are measured in acco
with the following instructions:

(1) The TOTAL LENGTH is the distance between the tip of the nose and th
the tail vertebræ. It is taken by laying the animal on a board, with its nose a
a pin or upright post, and by straightening the back and tail by extending th
legs with one hand while holding the head with the other; a pin is then driv
the board at the end of the vertebræ.

(2) THE LENGTH OF TAIL is the length of the caudal vertebræ. It is tak
erecting the tail at right angle to the back, and placing one point of the divid
the backbone at the very root of the tail, the other at the tip end of the verte

(3) The HIND FOOT is measured by placing one point of the dividers agai
end of the heel (*calcaneum*), the other at the tip of the longest claw, the foot
flattened for this purpose.

In measuring the hind foot in dry skins, the foot is first wrapped in wet abs
cotton until the toes can be straightened.

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

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WASHINGTON
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1890

U. S. DEPARTMENT OF AGRICULTURE, *June* 4, 1890.

SIR: I have the honor to transmit herewith No. 3 of NORTH AMERICAN FAUNA. It contains part of the results of a Biological Survey which I had the honor to conduct, under your instructions, in the San Francisco Mountain region in Arizona during August and September, 1889.

Respectfully,

C. HART MERRIAM,
Chief of Division of
Ornithology and Mammalogy.

HON. J. M. RUSK,
Secretary of Agriculture.

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. Map of the San Francisco Mountain Region, showing the distribution of *Picea engelmanni*, *Pseudotsuga douglasii* and *Juniperus occidentalis monosperma*.
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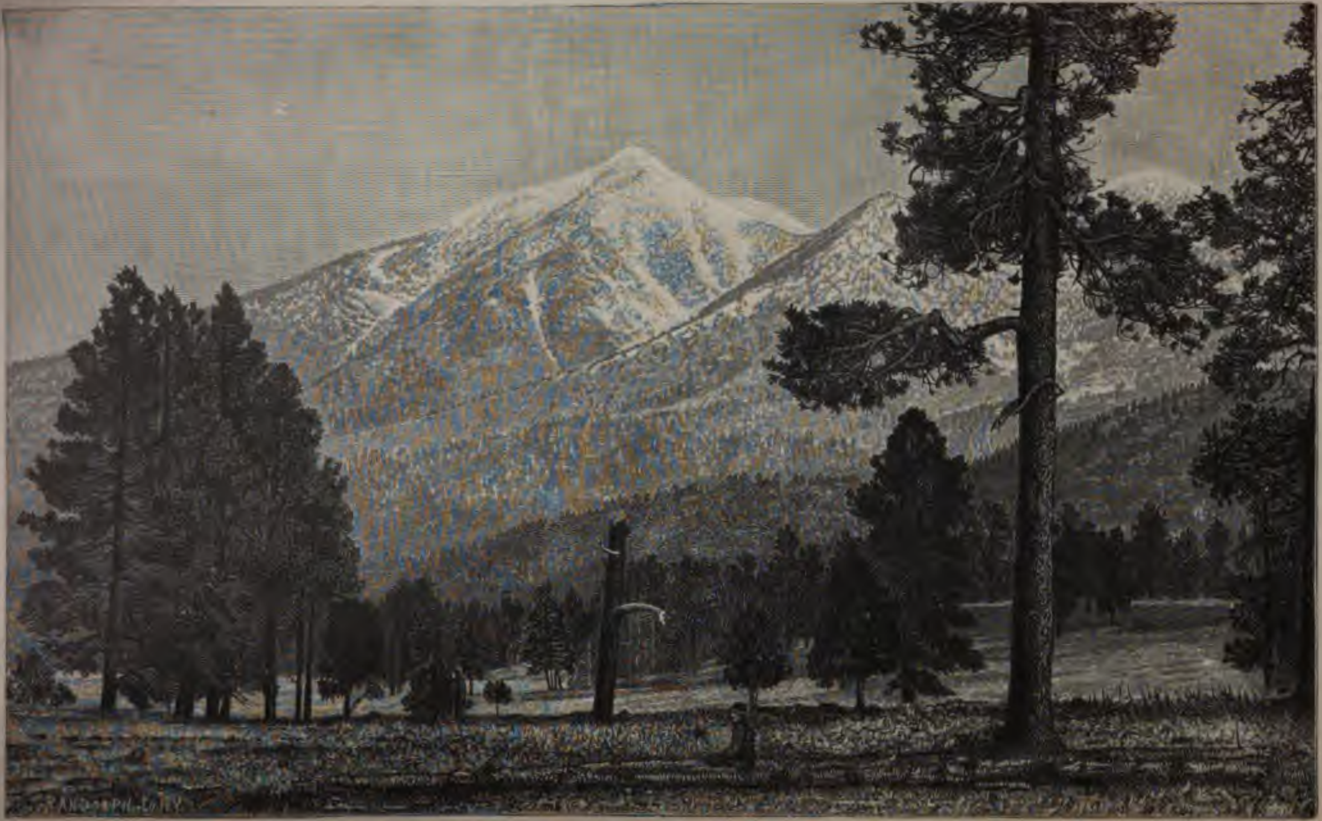

SAN FRANCISCO PEAK. AGASSIZ PEAK.

No. 3. NORTH AMERICAN FAUNA. August, 1890.

RESULTS OF A BIOLOGICAL SURVEY OF THE SAN FRANCISCO MOUNTAIN REGION AND DESERT OF THE LITTLE COLORADO IN ARIZONA.

By Dr. C. HART MERRIAM.

PREFATORY NOTE.

Recent explorations in the west, conducted by the Division of Ornithology and Mammalogy of this Department, led to the belief that many facts of scientific interest and economic importance would be brought to light by a biological survey of a region comprehending a diversity of physical and climatic conditions, particularly if a high mountain were selected, where, as is well known, different climates and zones of animal and vegetable life succeed one another from base to summit. The matter was laid before the Assistant Secretary of Agriculture, the Hon. Edwin Willits, and I was authorized by the Secretary, the Hon. J. M. Rusk, to undertake such a survey of the San Francisco Mountain region in Arizona. San Francisco Mountain was chosen because of its southern position, isolation, great altitude, and proximity to an arid desert. The area carefully surveyed comprises about 13,000 square kilometers (5,000 square miles), and enough additional territory was roughly examined to make in all about 30,000 square kilometers (nearly 12,000 square miles), of which a biological map has been prepared. No less than twenty new species and subspecies of mammals were discovered, together with many new reptiles and plants; and the study of the fauna and flora as a whole led to unexpected generalizations concerning the relationships of the life areas of North America, necessitating a radical change in the primary and secondary divisions recognized.

The most important of the general results are:

(1) The discovery that there are but two primary life areas in North America, a northern (boreal) and a southern (subtropical), both extending completely across the continent and sending off long interpenetrating arms.

(2) The consequent abandonment of the three life areas commonly accepted by naturalists, namely: The Eastern, Central, and Western Provinces.

(3) The recognition of seven minor life zones in the San Francisco Mountain region, four of boreal origin, and three of subtropical or mixed origin.

(4) The correlation of the four boreal zones with corresponding zones in the north and east.

The present paper consists of five parts: (1) an announcement of the general results of the survey, with special reference to the geographic and vertical distribution of species; (2) results of a brief visit to the Grand Cañon of the Colorado; (3) an annotated list of the Mammals of the San Francisco Mountain region including the desert of the Little Colorado, with descriptions of new species; (4) an annotated list of the Birds; (5) an annotated list of the Reptiles and Batrachians, with descriptions of new species.

Prof. F. H. Knowlton, assistant paleontologist, U. S. Geological Survey, joined the party in the summer and collected the plants upon which many of my generalizations are based. He has placed me under great obligations by allowing me the unreserved use of this material and the privilege of announcing important results from the stand-point of the geographic distribution of species. I am indebted also to Mr. Frederick V. Coville, assistant botanist, U. S. Department of Agriculture, for the determination of many of the more difficult plants.

Dr. Leonhard Stejneger, curator of reptiles in the U. S. National Museum, joined the expedition in September. Though unable to visit the desert region, he made notes and colored sketches from the living animals collected by Mr. Bailey and myself, and has prepared the report on Reptiles and Batrachians which constitutes part four of the present bulletin.

My assistant, Mr. Vernon Bailey, deserves special recognition for the faithful and efficient performance of the duties assigned him, and it should be added that much of the success of the season's work is due to his zeal and intelligence.

It is proper also to acknowledge the assistance rendered by Mr. D. M. Riordan, and his brothers Thomas and M. J. Riordan, of Flagstaff, Arizona.

Much more would have been accomplished but for the insufficient fund available for the survey (only a little more than $600 to cover the total cost of transportation, outfitting, hire of animals and men, purchase of tents, supplies, etc.), thus permitting the employment of but one man as cook and general camp-hand; while the animals, both in number and quality, were far below the standard usually considered necessary for field work, which circumstance caused many annoying delays. All our traveling was done on horseback, and our packing on burros.

The altitudes given in the present paper were determined by means of aneroid barometers, and too much confidence must not be placed in their extreme accuracy.

The base maps made use of are those of the U. S. Geological Survey, for which I am indebted to the Director of the Survey, Maj. J. W. Powell, and to the chief geographer, Mr. Henry Gannett. The picture of San Francisco Mountain, which forms the frontispiece of this report, is from the sixth annual report of the U. S. Geological Survey.

The colored map of Arizona, showing the life areas of the Colorado plateau south of the Grand Cañon (map 1), is based upon the present survey, supplemented by information derived from the U. S. Geological Survey.

For the sake of convenience, the names employed to designate the various life areas are those in common use; and the author wishes to state that he does not commit himself to these names, or to the relative value of the terms indicating rank (Province, Region, Zone, etc.), all of which have been employed in diametrically opposite ways by different writers.

ITINERARY.

The following brief itinerary, in connection with the accompanying maps, will enable the reader to trace the routes of the expedition and determine the positions of the localities mentioned in the report.

Flagstaff, Arizona, a station on the Atlantic and Pacific Railway, is the point of departure for San Francisco Mountain. I reached Flagstaff July 26, 1889, and was joined next day by my assistant, Mr. Vernon Bailey. After spending three days in outfitting, we proceeded to Little Spring, at the north base of San Francisco Mountain, and pitched our tents in a grove of aspens and pines, on a knoll just northwest of the spring, at an altitude of 2,500 meters (8,250 feet). This was our base camp for two months, and from it numerous side-trips were made into the surrounding country. Three of these were of special importance, namely, two trips across the Painted Desert and one to the Grand Cañon of the Colorado. During these expeditions I crossed the Painted Desert and the Rio Colorado Chiquito four times, spending in all sixteen days on the desert. I visited also Walnut Cañon, about 9 kilometers (5½ miles) south of Elden Mountain; and local collections were made in the piñon and chaparral near a volcanic crater containing ruins of cliff dwellings 8 kilometers (5 miles) east of O'Leary Peak, and in various other directions. A branch camp was established just below timber line on the main peak of San Francisco Mountain, and the rocky summit above timber line was climbed several times. Kendrick and O'Leary Peaks also were ascended.

FIRST TRIP TO PAINTED DESERT, AUGUST 12 TO 19, INCLUSIVE.

The route followed skirted the north and east sides of San Francisco Mountain, passing through the pine forest by way of Partridge Spring, and along the edge of O'Leary Park, keeping west of O'Leary and

Sunset Peaks, and thence turning southeasterly to Turkey Tanks. The dry bed of the Little Colorado River was crossed at Grand Falls, and Tenebito Wash was followed to the high mesa on the east side of the desert; this mesa was ascended and a trail was taken northward to a point about 25 kilometers (16 miles) north, or a little west of north, of the Moki pueblo of Oraibi; an abrupt turn to the south was then made, and Grand Falls was reached by an Indian trail south of that taken on the outward journey, a short stop having been made at Oraibi, where water and goat's milk were obtained from the Indians. From Grand Falls the course lay across the lava beds direct to the north base of the mountain, instead of by way of Turkey Tanks, as on the outward journey. The total distance traveled was 370 kilometers (230 miles). The heat was intense and much suffering was occasioned by want of water.

SECOND TRIP ACROSS THE DESERT, SEPTEMBER 20 TO 27, INCLUSIVE.

A northeasterly course was taken from Little Spring to Black Tank, thence to the Little Colorado at Tanner's Crossing, following the Mormon trail and crossing the river about 56 kilometers (35 miles) north of Grand Falls, and continuing in a northeasterly direction to Moencopie Wash, which was followed to Echo Cliffs, and the southern point of Echo Cliffs mesa was crossed from Moa Ave to Tuba. Tanner's Gulch and the Pueblo of Moencopie were visited and Moencopie Wash was followed down to the point of departure for Echo Cliffs, whence the return to the mountain was made by nearly the same route as on the way out, the total distance traveled being about 280 kilometers (175 miles). The temperature was very much lower than during the former trip across the desert, and some of the nights were even cold. The recent heavy showers had left some water in the Little Colorado and in scattered alkaline pools in Moencopie Wash, and also in the gulches in the lava beds between San Francisco Mountain and the Little Colorado.

TRIP TO THE GRAND CAÑON OF THE COLORADO, SEPTEMBER 9 TO 16, INCLUSIVE.

The usual road was followed from Little Spring to Hull Spring and Red Horse Tank, and thence to the tank known as Cañon Spring on the Cocanini Plateau, close to the cañon, which is here about 1,800 meters (6,000 feet) in depth. Mr. Bailey and myself climbed down into the cañon and remained in it two days and two nights.

PART I.—GENERAL RESULTS OF A BIOLOGICAL SURVEY OF THE SAN FRANCISCO MOUNTAIN REGION IN ARIZONA, WITH SPECIAL REFERENCE TO THE DISTRIBUTION OF SPECIES.

By Dr. C. HART MERRIAM.

GENERAL PHYSICAL FEATURES OF ARIZONA.

Arizona as a whole may be readily divided into two very distinct physiographic areas—an elevated plateau area and a low desert area. A high cliff or escarpment, one of the best marked and most extensive in the North American continent, enters Arizona from Utah and completely crosses the Territory from northwest to southeast, marking the southern limit of the great Colorado Plateau. Though it does not everywhere maintain the form of a precipitous cliff, it has an average height of at least 1,200 meters (4,000 feet), and in some places its crest is more than 1,500 meters (5,000 feet) above the plain below. In its effects upon the life of the region it is an important faunal barrier. The region to the south is in the main an arid desert, interrupted by a few irregular ranges of mountains. The region to the north, beginning at the top of the cliff and occupying the northern part of Arizona, is a southward continuation of the Great Interior or Colorado Plateau, the plateau on which the Rocky Mountains rest.

GENERAL FEATURES OF THE SAN FRANCISCO MOUNTAIN REGION.

San Francisco Mountain is on this plateau, in the north-central part of the Territory (in latitude 35° 20′ N.; longitude 111° 41′ W.). It is a volcanic peak rising 3,900 meters (12,794 feet) above sea-level and rests on a lava base which is everywhere more than 2,130 meters (7,000 feet) in elevation, and overlies red sandstone and carboniferous limestone. This plateau comprises about 2,000 square kilometers (800 square miles), and measures about 72 kilometers (45 miles) from east to west by 53 kilometers (33 miles) from north to south.

Four other volcanic peaks (O'Leary, Kendrick, Sitgreaves, and Bill Williams), ranging in height from 2,750 to 3,200 meters (9,000 to 10,500 feet), together with many buttes, cones, and craters, some of which contain 'crater lakes,' occupy the same elevated base level. San Francisco Mountain proper, cut off from all surrounding and attached hills and buttes at the height of 2,450 meters (8,000 feet), is about 19 kilometers (12 miles) in north and south diameter by 15 kilometers (9 miles) in east and west diameter, and covers about 180 square kilometers (70 square miles).

The lava plateau above 2,130 meters (7,000 feet) altitude is covered throughout by a beautiful forest of stately pines (*Pinus ponderosa*), which average at least 33 meters (100 feet) in height. There is no undergrowth to obstruct the view, and after the rainy season the grass beneath the trees is knee-deep in places, but the growth is sparse on account of the rocky nature of the surface. The pine forest extends up the mountain as high as 2,675 meters (8,800 feet), but loses its distinctive character at about 2,500 meters (8,200 feet), where it is replaced in the main by a forest of Douglas fir (*Pseudotsuga douglasii*), the same as that found from California to Puget Sound and British Columbia. The Douglas fir reaches an altitude of about 2,800 meters (9,200 feet), here giving place to Engelmann's spruce (*Picea engelmanni*), which covers the mountain sides between the altitude named and timber line (about 3,500 meters (11,500 feet). The fox-tail pine (*Pinus aristata*) begins a little lower down than Engelmann's spruce and accompanies it to the upper limits of tree growth, where both exist as depauperate forms scarcely more than a foot in height. The summit of the mountain above timber line consists of bare volcanic rock and is covered with snow about nine months of the year.

Again passing down to the plateau, and thence in an easterly direction to lower levels, a zone of cedar and piñon is first encountered—a belt varying in width from one to several miles according to the steepness of the slope. The only trees in this belt are junipers (locally known as 'cedars') and the piñon or nut pine (*Pinus edulis*), whose nut furnishes food to the Indians and the mammals and birds of the region. Descending still lower, the Desert of the Little Colorado is entered—an arid, treeless area whose upper limit may be set at the 1,800 meter (approximately 6,000 foot) contour or level. Parts of this desert are devoid of vegetation, while other parts support a scanty growth of cactus, greasewood, and a few other species.

In the foregoing account the general features of the several zones of the San Francisco Mountain region have been briefly outlined. Recapitulating, it may be said that in ascending from the hot and arid Desert of the Little Colorado to the cold and humid summit of the mountain no less than seven zones are encountered, each of which may be characterized by the possession of forms of life not found in the others. These zones, with their respective altitudes, are—first, the arid Desert region, below 1,800 meters (6,000 feet); second, the Piñon belt, from 1,800 to 2,100 meters (6,000 to 7,000 feet); third, the Pine, from 2,100 to 2,500 meters (7,000 to 8,200 feet); fourth, Douglas fir, from 2,500 to 2,800 meters (8,200 to 9,200 feet); fifth, Engelmann's spruce, from 2,800 to 3,500 meters (9,200 to 11,500); sixth a narrow zone of dwarf spruce; and seventh, the bare rocky summit, snow covered the greater part of the year.[*] These facts as isolated facts would be of comparatively little interest, but in their bearing on the problems of geographic distribution a very deep interest attaches to them. This will appear by passing in review the distinctive plants and animals of the several zones, and tracing their distribution in other parts of their ranges.

REMARKS ON THE GEOGRAPHIC DISTRIBUTION OF SPECIES CHARACTERISTIC OF THE SEVERAL ZONES OF THE SAN FRANCISCO MOUNTAIN REGION IN ARIZONA.

ALPINE ZONE.

[Approximate altitude: Above 3,500 meters, or 11,500 feet.]

Nine species of plants which grow on the bleak and storm-beaten summit of San Francisco Mountain were brought back from Lady Franklin Bay by Lieut. (now General) A. W. Greely. These species are:

Androsace septentrionalis
Arenaria verna
Cerastium alpinum
Cystopteris fragilis
Saxifraga cæspitosa
Saxifraga flagellaris
Saxifraga nivalis
Oxyria digyna
Trisetum subspicatum

One or more of them have been found at each of the following localities: British Columbia, Unalaska, Bering Strait, Kotzebue Sound, Point Barrow, Melville Island, Back's Great Fish River, Hudson Bay and Strait, Labrador, Baffin Bay, Greenland, Iceland, Spitzbergen, Newfoundland, Gulf of St. Lawrence, White Mountains of New Hampshire, Rocky Mountains, Selkirks, and Sierra Nevada. Several of them occur also in the arctic portions of the Old World, extending as far south along the coast as the island of Yeso, North Japan, and appearing again in the high mountains of Roumelia, in the Caucasus, the Carpathian Mountains, and the Alps.

Sibbaldia procumbens is another polar species inhabiting arctic America from the peninsula of Unalaska to Hudson Bay, Labrador, and Greenland, and flourishing also throughout the arctic regions of Asia. It comes south along the higher summits of the Cascade range, the Sierra Nevada, and the Rocky Mountains, and occurs in isolated colonies on the barren peaks of San Francisco Mountain in Arizona and Mount Washington in New Hampshire. In the same way it inhabits the mountains of Central Asia and Siberia, and also the Carpathian Mountains, the Apennines, the Alps, the Pyrenees, and the Himalaya.

Geum rossii belongs to the same category, growing from Greenland

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[*] The normal altitudes here given for the various tree zones of San Francisco Mountain are averages for the northwest side of the mountain. Favorable southern and southwestern exposures carry the zones up a hundred meters or more above these limits, while similar northern and northeastern exposures, particularly in gulches and cañons, deflect the zones as much as two, or even three hundred meters. The normal average difference in altitude of the same zone on the southwest and northeast sides of San Francisco Mountain is about 275 meters (900 feet).

and the shores and islands of Hudson Strait to Melville Island and the coasts of Bering Strait and Unalaska, and also in the northern part of Siberia and Kamschatka. It comes southward in the Rocky Mountains, inhabiting the higher peaks of the Uintas and of Colorado, and is the most conspicuous plant above timber line on San Francisco Mountain, where it forms dense mats of green among the bare rocks—patches of such extent that they may be seen from the plateau level below.

Other arctic plants found above timber line on San Francisco Mountain, most of them circumpolar species, are:

Arenaria alpina
Cerastium arvense
Festuca brevifolia
Polemonium confertum
Sagina linnæi
Saxifraga debilis
Silene acaulis
Stellaria umbellata
Thlaspi alpestre

It appears from what has been said that many of the plants found on the high rocky summit of San Francisco Mountain occur on the higher peaks of the Rocky Mountains, the Sierra Nevada* and Cascade range, and the Appalachian chain; they occur along the arctic coasts of Alaska, Hudson Strait, North Labrador, Greenland, North Siberia, and Spitzbergen; they occur in the Alps of Europe, in the Altai and Ural Mountains, the Pyrenees, and some of them even in the Himalaya. In brief, they inhabit the arctic regions of the globe and extend far south on the summits of the higher mountain ranges. Plants and animals having such a distribution are termed *Arctic-Alpine Circumpolar species.*

We collected no insects at high altitudes on San Francisco Mountain, but butterflies and diptera from great elevations in Colorado have been shown to be identical with species from Mount Washington, Labrador, and Greenland.

Among birds, the Golden Eagle—a truly circumpolar species, though not confined to the arctic zone—rears its young on San Francisco Mountain.

There are no exclusively arctic mammals on the top of this high mountain, because such mammals could not exist long in so small an area. An Ermine Weasel (*Putorius* sp. ——?) inhabits the summit, and the Big-horn or Mountain Sheep, another truly circumpolar type, spends the summer there, descending in winter to lower levels.

SUB-ALPINE OR TIMBER-LINE ZONE.

[Approximate altitude, 3,200–3,500 meters, or 10,500–11,500 feet.]

Just below the barren arctic summit of the mountain is a narrow belt which may be named the Timber-line zone. Here the trees which reach timber line (in this case *Picea engelmanni* and *Pinus aristata*) lose the upright or arborescent habit and exist as stunted and prostrate trunks, whose gnarled and weather-beaten forms bear testimony to the severity of their struggle with the elements. In this narrow belt a number of hardy little plants attain their maximum development, decreasing rapidly in abundance both above and below. Among these are:

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* Engler tells us that 26 per cent. of the plants found on the High Sierra Nevada are found also in the Alps and throughout arctic Europe.

Arenaria biflora carnulosa
Cerastium alpinum behringianum
Corallorhiza multiflora
Draba aurea
Epilobium saximontanum
Gentiana barbellata
Gentiana tenella
Heuchera rubescens
Luzula spadicea parviflora
Pedicularis parryi
Phleum alpinum
Potentilla dissecta
Primula parryi
Saxifraga debilis
Sedum rhodanthum
Veronica alpina

Many of them are circumpolar species found throughout the northern regions of America, and some of them throughout the northern regions of the world, coming south on high mountains and occurring in greatest perfection just at or near the edge of the northern limit of trees, and at timber-line on mountains further south. Such plants are known to botanists as '*Sub-Alpine species*,' and it would be well if the term *sub-alpine* were restricted to the characteristic species of this zone.

Among birds, the Titlark (*Anthus pensilvanicus*) was found at the top of the mountain, where it probably breeds. It breeds in grassy places on the high peaks of the Rocky Mountains, and at sea-level in Labrador, Greenland, and throughout arctic America; and birds congeneric with it are known to breed throughout the arctic portions of the Old World.

(CENTRAL) HUDSONIAN OR SPRUCE ZONE.

[Approximate altitude, 2,800–3,200 meters; or 9,200–10,500 feet.]

Passing down into the next zone, the Spruce zone, a number of plants, birds, and mammals are encountered, which are characteristic of humid northern regions, but regions not quite so cold as those inhabited by the species which occur on the snowy summit and at timber-line. The characteristic trees of this zone are Engelmann's spruce (*Picea engelmanni*) and the fox-tail pine (*Pinus aristata*). Some of the small plants are:

Aquilegia chrysantha
Lathyrus arizonicus
Mertensia paniculata
Moneses uniflora
Pentstemon glaucus stenosepalus
Pyrola chlorantha
Ribes setosum
Solidago multiradiata
Zygadenus elegans

The fact of present interest is that many of the plants here enumerated as growing in the Spruce zone of this mountain are equally characteristic of the upper spruce belt of the higher Alleghanies, the Rocky Mountains, the Cascades, and the Sierra Nevada, and occur also in the great northern spruce forest of Canada. It is well known that the northernmost part of our own continent consists of bare rock and frozen tundras. There are no trees along the sea edge of Labrador or Hudson Strait, or along the coast region of arctic America from Boothia Felix to Alaska, but just south of this region a large forest begins which has been called the 'Great Pine Forest.' There is not a pine tree in it, but it is called pine because conifers in general are called pines by people who are not botanists. The tree that grows there is a species of spruce congeneric with the spruce which occurs high up on San Francisco Mountain, and many of the humbler plants are either identical or closely related representative forms.

Among the birds which breed in the Spruce belt on this mountain are the Goshawk, Dusky Horned Owl, Dusky Grouse, Evening Grosbeak, and Clark's Crow. The Goshawk and Dusky Horned Owl range throughout the spruce forests of the north, from Labrador to Alaska, and south in the mountains; while the others are confined to its western parts and outliers.

Of mammals, the Porcupine is the only one believed to be restricted to this belt during the season of reproduction, and, like the Big-horn, it comes down to lower levels during the winter. Bears (*Ursus*), Shrews (*Sorex*), Voles (*Arvicola*), and Red Squirrels (*Sciurus fremonti mogollonensis*) range throughout the spruce and fir zones but were not found below.

(CENTRAL) CANADIAN OR BALSAM FIR ZONE.

[Approximate altitude: 2,500–2,800 meters; or 8,200–9,200 feet.]

The distinctive tree of this zone is Douglas fir (*Pseudotsuga douglasii*), which ranges northward to British Columbia. Another tree of nearly coincident vertical distribution on the mountain is the lofty Rocky Mountain Pine (*Pinus flexilis macrocarpa*), which extends north to the Kootenai region and Calgary in Canada. Wherever the Douglas fir has been burned off, its place is taken by the aspen (*Populus tremuloides*), a species of wide distribution in the north, where it ranges from New England to Newfoundland and Labrador, and thence westward to Alaska, reaching its highest perfection along the southern part of the great coniferous forest of northern Canada, and coming south in the mountains.

Among the smaller plants of the Douglas fir zone are:

Actæa spicata
Berberis repens
Ceanothus fendleri
Gentiana affinis
Gentiana heterosepala
Geum triflorum
Potentilla fruticosa
Ribes rusbyi
Viola canadensis scopulorum

Nearly half of the above (namely, *Geum triflorum*, *Potentilla fruticosa*, *Actæa spicata*, and *Viola canadensis*) have a wide range in the Canadian flora of the East and North, or are representative forms of such species; and probably *Ceanothus fendleri* may be safely regarded as the western representative of *C. ovatus*, which ranges eastward from the Rocky Mountains to Vermont.

One batrachian, a Salamander of the genus *Amblystoma*, has been found in this zone. Allied species inhabit the Canadian fauna of the East.

A number of species of birds are characteristic of the Douglas fir zone. At least eight of these are either identical with or closely related representative forms of species which are well-known members of the *Canadian fauna* of the East, most of them breeding in northern New ngland, the Adirondacks, and southward in the Alleghanies. These re:

hree-toed Woodpecker (*Picoides americanus dorsalis*)
hive-sided Flycatcher (*Contopus borealis*)
rossbill (*Loxia curvirostra stricklandi*)
ine Linnet (*Spinus pinus*)
udubon's Warbler (*Dendroica auduboni*)
Brown Creeper (*Certhia familiaris montana*)
Ruby-crowned Kinglet (*Regulus calendula*)
Audubon's Thrush (*Turdus aonalaschkæ auduboni*)

The following species which breed in the Douglas fir belt on San rancisco Mountain do not occur in the East, though but one genus *Myadestes*) is unrepresented in the East:

ownsend's Solitaire (*Myadestes townsendii*)
road-tailed Humming-bird (*Trochilus platycercus*)
Long-crested Jay (*Cyanocitta stelleri macrolopha*)
Louisiana Tanager (*Piranga ludoviciana*)
Mountain Chickadee (*Parus gambeli*)

It is probable that *Parus gambeli* and *Myadestes townsendii* range up rom the Fir into the Spruce zone.

Of mammals, there are two species of Field Mice or Voles (*Arvicola lticolus* and *A. mogollonensis*), one Shrew (*Sorex monticolus*), and one ed Squirrel (*Sciurus fremonti mogollonensis*), all of which extend up nto the Spruce belt, but none of which were found below. It is evident hat the Spruce and Balsam zones are closely related.

NEUTRAL OR PINE ZONE.

[Approximate altitude: 2,100–2,500 meters, or 7,000–8,200 feet.]

The characteristic and only tree of the Pine zone is *Pinus ponderosa*, hich forms an unbroken forest over the whole of the lava plateau above e altitude of 2,100 meters (about 7,000 feet) and extends up as high, some of the parks, as 2,675 meters (8,800 feet). As a distinctive ecies, however, it loses its character at about 2,500 meters (8,200 feet) here it is invaded, and soon after replaced, by *Pinus flexilis*, *Pseudotsuga douglasii*, and *Populus tremuloides*. *Pinus ponderosa* may be rerded as a tree of the middle elevations, occurring between the piñon d cedar of the lower hills, and the firs and spruces of the higher ountains. In such situations it ranges from the highlands of western exas and northern Mexico, northward along the Rocky Mountains and erra Nevada to the dry interior of British Columbia, in latitude 51°, , avoiding the region of excessive rain-fall along the coast from north-n California northward.

Among the more conspicuous of the small plants occurring in the Pine elt of San Francisco Mountain, and having a more or less coincident istribution with that of *Pinus ponderosa* just cited, are:

mpanula parryi
ssera speciosa
Gilia aggregata attenuata
Oxybaphus angustifolius
Oxytropis lamberti
Pentstemon barbatus torreyi

The one distinctive mammal of the Pine belt is Abert's Squirrel (*Sciurus aberti*) which ranges through the pine regions of Arizona, New

Mexico, and Colorado, and has been reported from Durango, in Mexico. Very little can be said with certainty as to the characteristic birds of the Pine belt, the date of my arrival at the mountain being so late (end of July) that the birds had finished breeding and were beginning to wander. The following species, however, were nearly confined to the pines at that date and are known to breed there:

Red-backed Junco (*Junco cinereus dorsalis*)
Nuttall's Poor-will (*Phalænoptilus nuttali*)
Western Flycatcher (*Empidonax difficilis*)
Richardson's Flycatcher (*Contopus richardsoni*)
Pigmy Nuthatch (*Sitta pygmæa*)

The only reptile found in the Pine belt is a handsome horned toad (*Phrynosoma hernandesi*), which is abundant.

PIÑON ZONE.

[Approximate altitude, 1,800-2,100 meters, or 6,000-7,000 feet.]

The distinctive trees of this zone are the piñon, or nut pine (*Pinus edulis*), and the so-called 'cedar' (*Juniperus occidentalis monosperma*) both averaging about 5 meters (16½ feet) in height. The singular checker-bark juniper (*Juniperus pachyphlæa*), a very handsome and conspicuous species, occurs in two or three special localities, but is rare. Several large shrubs not observed elsewhere are abundant in parts of this belt, namely, *Berberis fremonti*, *Rhus aromatica trilobata*, and *Spiræa discolor dumosa*. Near the Grand Cañon of the Colorado and again at Walnut Cañon, where the lava rock gives place to limestone, these shrubs are joined by *Cowania mexicana*, *Spiræa millifolium*, and *Robinia neo-mexicana;* and *Yucca angustifolia* is replaced by *Yucca baccata*. *Juniperus californica utahensis* also grows at the Grand Cañon. A dense chaparral (*Fallugia paradoxa*) forms extensive thickets east of O'Leary Peak and occurs sparingly over most of the Piñon belt, even extending down into the desert in places. Both the piñon and cedar occupy elevations of corresponding temperature in the arid lands from western Texas through New Mexico and Arizona and north to central Colorado, and the cedar reaches westward to southern California. Closely related and strictly representative forms extend northward through the Great Basin to the Plains of the Columbia. The other species mentioned occupy more or less of the same range, and some of them push northward over the Great Plains as well as the interior basin.

The most conspicuous bird of the Piñon belt is the Piñon Jay (*Cyanocephalus cyanocephalus*). Other characteristic species are Woodhouse's Jay (*Aphelocoma woodhousei*), the Gray Tufted Tit (*Parus inornatus griseus*), the Gnatcatcher (*Polioptila cærulea*), and the Bush Tit (*Psaltriparus plumbeous*). The range of these species, taken collectively, is co-extensive with the distribution of the cedar belt above described.

The large Rock Squirrel (*Spermophilus grammurus*) is the most characteristic mammal of the Piñon belt, with which its range appears to be nearly coincident. It occurs in suitable localities from western Texas to the Great Basin in Utah and Nevada. Two or three small mammals, characterized by darkness of coloration, seem to be restricted to this belt, namely, *Spermophilus spilosoma obsidianus*, *Perognathus fuliginosus*, and *Onychomys fuliginosus*, which are here described for the first time. (See part III.)

Lizards abound in the Piñon belt, becoming more numerous toward the desert, but two species (*Sceloporus consobrinus* and *Uta ornata*) which abound in the Piñon belt were not found in the desert below.

THE DESERT AREA.

[Approximate altitude: 1,200–1,800 meters, or 4,000–6,000 feet.]

The Desert of the Little Colorado, sometimes known as the 'Painted Desert,' is a great basin about 1,000 meters (3,300 feet) in depth, situated on the top of the plateau. It was excavated, as its name indicates, by the drainage system of the Little Colorado River—the Colorado Chiquito of the Mexicans—and consequently is lowest at the north, its slope being *away* from the southern edge of the plateau. The river has cut its bed down to about 820 meters (2,700 feet) at the point where it empties into the Grand Cañon of the Colorado, and throughout the lower part of its course it flows through a cañon considerably below the level of the desert proper, the lowest part of which is but little less than 1,200 meters (approximately 4,000 feet) in altitude. Its upper limit may be set at 1,800 meters (6,000 feet). The term Painted Desert should be restricted, it seems to me, to that part of the basin which is below 1,500 meters (approximately 5,000 feet).*

The geology of the region is simple. The lowest stratum which comes to the surface is carboniferous limestone; above this is red sandstone, which in turn is overlaid by the so-called variegated marls or argillaceous clays, sometimes capped by a thin layer of impure coal or lignite. The limestone appears on the west side of the river only (?), where it is soon buried under the ancient lava floods from San Francisco Mountain and neighboring craters. The red sandstone is encountered everywhere, sometimes as surface rock, sometimes as high cliffs forming the escarpments of broad mesas, and sometimes as curiously sculptured tablets standing on the plain. The marls are widely distributed, and in many

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*The area below 1,370 meters (4,500 feet) is about 120 kilometers (75 miles) in length, and that below 1,500 meters (5,000 feet), 200 kilometers (125 miles). The long axis of the desert, slightly crescentic in form, and curving from near the mouth of the Little Colorado in the northwest to New Mexico in the southeast, is 320 kilometers (200 miles) in length, with a transverse diameter of about 110 kilometers (70 miles) along the middle portion, and a total area of 29,800 square kilometers (11,500 square miles). Its eastern edge penetrates the boundary of New Mexico in two arms, following the usually dry courses of the Zuñi and the Carrizo, and nearly reaches the boundary along the *Rio Puerco, the largest* tributary of the Colorado Chiquito.

places, particularly south of the lower part of Moencopie Wash,* rise from the surface level in the form of strangely eroded hills and ranges of stratified cliffs whose odd shapes and remarkable combinations of colors—red, white, blue, brown, yellow, purple, and green—have given the area in which they occur the name 'Painted Desert.' There are hundreds of smoothly rounded, dome-shaped hills of bluish clay, utterly devoid of vegetation, and almost identical in appearance with the 'gumbo hills,' of the Bad Lands bordering the Little Missouri in North Dakota. Both the hills and the naked clayey flats between them abound in alkali vents—miniature craterlets—where the alkali effloresces, crusting over the surface in patches which resemble newly fallen snow. Many of the hills are capped with fossil wood, and many of the flats and lower levels east of the Little Colorado River are strewn with chips and pieces which have tumbled down during the wearing away of the hill-sides. Logs 30 to 50 centimeters (roughly, a foot or a foot and a half) in diameter and 9 to 12 meters (30 or 40 feet) in length are still common, and several sections were found, possibly from the same tree, which measured about 150 centimeters (5 feet) in diameter. There are pebble beds miles in extent, made up of agate, moss-agate, chalcedony, jasper, obsidian, and fossil wood, with not so much as a spear of grass or bit of cactus between them. On the other hand, many of the mesas and plains are covered with sand and decomposed marls which support a scanty growth of cactus, yucca, grease-wood, and a few other forms of vegetation characteristic of arid regions.

The bed of the Little Colorado River contains the only running water in this part of Arizona, and it 'goes dry' a large part of the year, a little water remaining in scattered pools, which are strongly alkaline. Some of the salt and alkali flats on the river-bottom support a luxuriant growth of a singular fleshy plant belonging to the genus *Salicornia*, which at a little distance looks like a leafless bush with thick green stems. During the rainy season, and whenever the river 'runs,' the liquid which flows down its course is red alkaline mud, about the consistency of ordinary sirup. This is the case also with its tributaries, of which Moencopie Wash and Tenebito Wash are the only ones which cross the Painted Desert proper.

The physical and climatic features of the Painted Desert are peculiar and striking, and result in the production of an environment hostile alike to diurnal forms of animal life and to the person who traverses it. The explorer is impressed with the unusual aspects of nature—the strange forms of the hills, the long ranges of red and yellow cliffs, the curiously buttressed and turreted buttes and mesas, the fantastic shapes

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* The terms 'wash' and 'arroyo' are applied to the deep channels or ravines so common in arid regions. "These arroyos are natural consequences of the unequal manner in which the rain falls throughout the year. Sometimes not a drop falls for several months; again, it pours down in a perfect deluge, washing deep beds in the *unresisting soil, leaving* behind the appearance of the deserted bed of a great river." —*Emory, Mexican* Boundary Survey, I, 1857, p. 57.

rocks carved by the sand-blast and rendered still more weird by
zy atmosphere and steady glare of the southern sun, the sand-
moving swiftly across the desert, the extraordinary combina-
colors exposed by erosion, the broad clayey flats whitened by
s of alkali and bare of vegetation, the abundance of fossil-wood,
ensive beds of shining pebbles, the unnatural appearance of the
mountain sharply outlined against the yellow sky, the vast
es of burning sand, the total absence of trees, the scarcity of
the alluring mirage, the dearth of animal life, and the intense
rom which there is no escape.*

plant life of the desert is scattered and scanty, and consists of
haracteristic arid land forms as grease-wood (*Atriplex canescens*,
ertifolia, and *Sarcobatus vermiculatus*); weeds of the genera *Dico-*
l *Oxytænia* (*D. brandigei* and *O. acerosa*); a large brush-like shrub
lymia canescens) with flowers suggesting the golden-rod; the
r *Ephedra*, which has no apparent foliage; the narrow-leaved
Yucca angustifolia), and cactuses of several genera. But it must
supposed that these rank and spiny forms of vegetation, whose
dull olive colors are in perfect harmony with the parched and
aspects of the desert, are the only plants found there; for no
is the surface moistened by the passing showers of the so-called
season' than numerous plants spring into existence, and favored
f the desert lose something of their usual desolate and dreary
ance. There are places where even the nutritious grama-grass
oua) gains a precarious foot-hold, and where a dwarf lupine (*Lu-*

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tenant Ives and Dr. Newberry attempted to cross this desert from the Little
near Grand Falls, but were obliged to turn back the first day. After follow-
he river for three days they found an Indian trail leading north, and followed
Moki villages. The following quotation is from Ives's account of the first day
esert: "The scene was one of utter desolation. Not a tree nor a shrub broke
tony. The edges of the mesas were flaming red, and the sand threw back
s rays in a yellow glare. Every object looked hot and dry and dreary. The
began to give out. We knew that it was desperate to keep on, but felt un-
to return, and forced the jaded brutes to wade through the powdery impalpable
fifteen miles. The country, if possible, grew worse. There was not a spear of
d from the porousness of the soil and rocks it was impossible that there should
p of water. A point was reached which commanded a view twenty or thirty
ead, but the fiery bluffs and yellow sand, paled somewhat by distance, ex-
o the end of the vista. Even beyond the ordinary limit of vision were other
nd sand fields, lifted into view by the mirage, and elongating the hideous
r

bouse, in speaking of a somewhat similar desert which he crossed in western
, states that a coyote, "becoming desperate, rushed to the spring, and was
y one of the men with a stone." He says further: "The ravens were hover-
us while we remained here, eagerly watching our famished mules. Since we
Williams's Fork there have been clouds seen every day, and anxiously did
h for rain; but this seemed a thing impossible, to rain in this miserable coun-
re everything appears to be an enemy, and is armed with a thorn or a poison-
g."

pinus capitatus) is abundant; and the higher levels are adorned by a kind of painted-cup (*Castelleia*) and scattered beds of a rather coarse plant (*Mirabilis multiflora*) which suggests the morning glory. The delicate pink blossoms of the graceful *Malvastrum*, and the more showy yellow and orange flowers of *Riddellia tagetina* and *Zinnia grandiflora* would attract attention anywhere, and their beauty is here heightened by contrast with their sombre surroundings.

Without going into details it may be said that these plants, taken collectively, occur in the arid parts of northern Mexico,* Texas, New Mexico, Arizona, and southern California, and some of them extend north in the Great Basin, even reaching the Plains of the Columbia; and a few spread northward over the Great Plains east of the Rocky Mountains.

Large black beetles of the genera *Eleodes* and *Asida* are common on the Painted Desert and are characteristic arid land forms, occurring also in Mexico.

Toads of the peculiar genus *Spea*, modified for life in desert regions, were found after rains in some of the arroyos or washes, which are dry the greater part of the year.

Lizards are the most conspicuous forms of animal life and many species abound throughout the desert. Among them are:

Crotaphytus baileyi
Crotaphytus wislizenii
Sceloporus graciosus
Sceloporus elongatus
Uta stansburiana
Holbrookia maculata flavilenta
Phrynosoma ornatissimum

We saw only one rattlesnake, but others have been recorded. Several of the species and all of the genera of reptiles here mentioned occur also in Mexico.

Birds are scarce, both in species and individuals, and but few breed on the desert of the Little Colorado. The following species were observed there:

Black-throated Desert Sparrow (*Amphispiza bilineata*)
Nevada Sage Sparrow (*A. belli nevadensis*)
Boucard's Sparrow (*Peucæa ruficeps boucardi*)
Brewer's Sparrow (*Spizella breweri*)
Sage Thrasher (*Oroscoptes montanus*)
——— Thrasher (*Harporhynchus* sp. —?)
Burrowing Owl (*Speotyto cunicularia hypogæa*)

All of these are characteristic arid land birds, which come into the United States from Mexico and extend northward various distances. Boucard's Sparrow ranges north from the table-lands of Mexico to western Texas, New Mexico, and Arizona; the Black-throated Desert Sparrow, from Mexico and Texas westward to southern California and north in the Great Basin to Utah and Nevada; the Sage Sparrow, from Mexico north to the Plains of the Columbia; Brewer's Sparrow, from

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* The number of Arizona plants which occur in the northern part of Mexico is very large. Hemsley, in the botanical part of Biologia Centrali-Americana, states that of the 560 genera of Arizona plants mentioned by Rothrock, no less than 402, or 72 *per cent.*, *occur also in* northern Mexico.

Mexico north over the Great Plains and the Great Basin; the Sage Thrasher, from Mexico north through the Great Basin; and the Burrowing Owl, from southeastern Texas to California and northward to Canada wherever suitable localities exist. Another characteristic arid land bird, the Road Runner or Chaparral Cock (*Geococcyx californianus*), was not seen, but has been recorded from the Little Colorado, and, like the others,enters the United States from Mexico. It ranges from Texas to California and north to Colorado.

The characteristic mammals of the desert are small nocturnal forms, such as Kangaroo Rats (*Dipodomys*), Pocket Mice (*Chætodipus*, a subgenus of *Perognathus*), Big-eared Mice (*Hesperomys*—of the *eremicus* group), and Free-tailed Bats (*Nyctinomus*). All of these groups reach the United States from Mexico, and none of the species of the Painted Desert range much north of Arizona.

Thus it appears that most of the forms of life inhabiting the desert of the Little Colorado—its mammals, birds, reptiles, and plants—occur also in Mexico and extend northward as far as the arid lands are suited to their requirements; and some of its species range east into Texas and west into southern California.

In like manner it has been shown that the characteristic forms of life of the Piñon belt occur in similar areas in different parts of the arid lands from Mexico to the Plains of the Columbia; that lands which rise above the level of the Piñon belt are covered with forests of tall pines and in the main possess the same species from western Texas to British Columbia; that still higher elevations are clothed with balsam and spruce, and that the humbler plants, the birds, and the mammals of these balsam and spruce forests are essentially the same throughout the Rocky Mountains and the great northern forest of Canada from northern New England to Alaska; that the mountain peaks, if sufficiently high, are bare at the summit, or capped with snow and ice, and sustain the same species of plants that grow in the arctic regions of the world and come south on the high mountain ranges in all parts of the Northern Hemisphere; in brief, it has been found that the same species, or closely related representative species of animals and plants inhabit the remotest parts of these several zones that inhabit them on San Francisco Mountain.

INTERRELATIONS AND AFFINITIES OF THE SEVERAL ZONES.

The contemplation of the phenomena here described leads naturally to comparisons of similar areas throughout the country; to attempts to bring together these areas into natural biological zones and provinces, and to inquiries concerning their origin.

Without going into the history of the subject, it may be said that most zoologists recognize three primary zoo-geographical divisions in the United States—an '*Eastern*,' extending from the Atlantic Ocean to the Great Plains; a '*Central*,' from the eastern border of the Plains westward to the Sierra Nevada; and a '*Western*,' from the eastern base of the Sierra Nevada to the Pacific. The arid region of the Southwest which enters the United States from Mexico has been recognized as a distinct division by many naturalists, and has been named the '*Chihuahuan*' or '*Sonoran*' region.

The region east of the Great Plains was subdivided by Agassiz as early as 1854 into three areas which he called Faunas, namely: (1) a '*Canadian Fauna*,' (2) an '*Alleghanian Fauna*,' or Fauna of the Middle States, and (3) a '*Louisianian Fauna*,' or Fauna of the Southern States. Subsequent writers, particularly Verrill and Allen, have circumscribed these Faunas, reduced their rank, and increased their number until at the present time ornithologists recognize eight faunal areas in eastern North America, as follows: (1) Arctic; (2) Hudsonian; (3) Canadian; (4) Alleghanian; (5) Carolinian; (6) Louisianian; (7) Floridian; and (8) Antillean. Cope, from a study of the reptiles and batrachians, united the Louisianian and Floridian Faunas into a district of primary rank, which he named the '*Austroriparian*' region—the exact equivalent of Agassiz's Louisianian Fauna. Passing over this region as clearly of southern origin, there remain the Carolinian, Alleghanian, Canadian, Hudsonian, and Arctic Faunas. The three latter are boreal in their affinities, while the Carolinian is suffused with southern forms, and the Alleghanian seems to be neutral ground.

In studying the several life-zones of the higher declivities of San Francisco Mountain it became apparent not only that each has its corresponding zone in the East, but that in many instances the zones of the mountain may be recognized by the presence of the identical species which characterize them in New England and Canada. In short, it was found that the faunal and floral zones which go to make up the Boreal Province in the East may be traced in a northwesterly direction around the northern end of the Plains of the Saskatchewan and then south along the sides of the Rocky Mountains, even to this isolated peak in Arizona.[*] This has been pointed out somewhat in detail in the discussion under the head of each zone, and has been indicated further by the headings themselves.

Each zone, while possessing throughout a certain number of common or strictly representative species, undergoes a notable change in pass-ng from the East to the West, each extreme being occupied by certain pecies not found in the other. It is necessary to recognize this differnce in the names applied to the zones; hence the prefix 'central' has een used in each case to distinguish the Rocky Mountain arm from he eastern arm.

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[*] This will be made clear by a glance at the accompanying map of North America (map 5), on which the Boreal Province is represented in clear green.

Scudder, under the head of "Anomalies in the Geographical Distribution of our Butterflies," mentions a number of cases in which northern species of butterflies occur in supposed isolated colonies at remote points, all of which, it is significant to observe, fall within the boundaries of the Boreal Province here defined. He cites the brown elfin butterfly (*Incisalia augustus*) as a species throwing some light on this 'anomalous' distribution. It occurs, he states, in New England and New York, and south in the Alleghanies to West Virginia. North of the United States it has been found at Halifax, Quebec, Montreal, and thence westerly as far as Cumberland House on the North Saskatchewan. In the West it again enters the United States along the Rocky Mountains, and extends as far south as Colorado. A better example of a typical boreal distribution could hardly be desired.

The several zones of the San Franciso Mountain region are interrelated in different degrees, some very closely and others very remotely. Many species and even genera which are common to two or more zones, and consequently of no value whatever in defining the single areas, beome of the utmost importance in studying the interrelations of the several zones. For instance, in the highest group of all—the mammalia—there are representatives of four distinct types, namely, Bears, Shrews, Voles, and Red Squirrels, which range from the top of the timber-line belt to the bottom of the Canadian or Douglas fir zone.* All of these are circumpolar types, ranging over the boreal parts of the whole world and coming south in the mountains. It is clear, therefore, that they are of boreal origin. On the other hand, there are several very different types of mammals, among which may be mentioned the Kangaroo Rats, Pocket Mice, and Grasshopper Mice, which do not occur above the Piñon zone. These are southern types reaching the United States from the table-lands of Mexico and extending northward over the arid lands as far as the conditions are suited to their requirements. It is clear, therefore, that they are of southern origin. In short, it may be stated, as a result of this biological survey of the San Francisco Mountain region, that all the forms of life inhabiting Arizona were derived from one of two directions—the north or the south. And in extending these researches and generalizations so as to embrace the Great Interior Basin, the Rocky Mountain region, and the Great Plains, which together constitute the so-called 'Great Central Province,'† of naturalists, I was astonished to be forced into the belief that no such province exists. Indeed, the present investigation demonstrates that there are but two primary life provinces in this country: a northern, which may be termed *Boreal*, and a southern, which, for our purposes, may be termed *Sonoran*, since it comes to us from Mexico through Sonora. In attempting to arrange all the life zones of Arizona under these two headings the following conclusions have been reached: The Arctic-Alpine, Timber-line, Hudsonian, and Canadian zones, having been shown to be derived from the north, fall naturally under the *Boreal* division. The Desert and Piñon zones, having been shown to be derived from the south, fall naturally under the *Sonoran* division. There remains but one area, namely, the Pine area, whose relationships are in any way obscure. This area has been shown to consist of a mixture of Boreal and Sonoran types, more or less modified by adaptation to environment. In other words, it is neutral territory. But since the number of its Sonoran types is greatly in excess of its Boreal types, it may be more properly referred to the Sonoran Province. Therefore, of the seven life-zones of the San Francisco Mountain region in Arizona, four may be referred to the Boreal Province and three to the Sonoran.

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*Bears range over the lower levels at certain seasons of the year, but are not known to breed away from the spruce and fir forests.

†This province was outlined by Agassiz as long ago as 1854, and has been accepted so far as its essential features are concerned by LeConte, Baird, Wallace, Allen, Cope, Binney, Gray, Packard, and *nearly all recent* writers.

The zones composing each of these primary divisions are related to one another in different degrees. Thus, the Timber-line, Hudsonian, and Canadian zones are much more intimately related than the Timber-line and the Alpine; and the affinities of the Piñon and Desert are much closer than those of the Piñon and Pine. Hence it becomes possible to group the zones into categories of intermediate rank between the primary provinces and the tertiary zones or areas. These secondary divisions are here termed regions. Under the Boreal Province we may recognize two regions, an Arctic and a Boreal. The Arctic region contains but one zone, the Alpine. The Boreal region contains three zones, namely, the Timber-line, Hudsonian, and Canadian. The Sonoran or southern province may be likewise split into two regions, a Sub-Arid and an Arid. The Sub-Arid consists of a single zone, the Pine. The Arid region comprises two zones,* the Piñon and the Desert. The facts here set forth may be graphically represented by means of a table, thus:

Life Areas of the San Francisco Mountain Region in Arizona.

Provinces.	Regions.	Zones or Areas.
Boreal	Arctic	Alpine.
	Boreal	Timber-line.
		Hudsonian.
		Canadian.
Sonoran	Sub-Arid	Pine.
	Arid	Piñon.
		Desert.

The primary divisions are based on the possession of distinctive genera; the secondary and tertiary chiefly on distinctive species, though some of them possess distinctive genera also.

ORIGIN OF THE BOREAL FAUNA AND FLORA OF SAN FRANCISCO MOUNTAIN.

The Boreal zones of San Francisco Mountain are separated from corresponding areas elsewhere by a broad interval occupied by the upper faunas and floras of the Sonoran Province. The arctic summit of the mountain is distant more than 400 kilometers (250 miles) from the nearest peak of similar character in Colorado, and nearly 3,200 kilometers (2,000 miles) from the nearest point in the Arctic zone proper—all the arctic areas within the United States being mere dots upon the map, and even the lower zones of the Boreal Province being widely separated from similar areas in the north. The question naturally arises as to the origin of these small colonies of arctic life which appear here and there over a great continent. It is perfectly evident that they could not have reached their present positions during existing climatic conditions; hence it is necessary to search the records of the past for the explanation. The period immediately preceding the present is known as the glacial age, because the northern parts of the globe were then buried in ice. This ice cap, which in places was several thousand feet in thickness, underwent two principal movements of advance and retreat, first crowding the life of the region far to the southward, then allowing it to return, to be again driven south by the next advance. The southern terminus of the great ice sheet extended from New Jersey to southern Illinois, and thence northwestward to British Columbia, and its effects upon the climate must have been felt throughout the United States and even into Mexico. The advance of the glacial period was so gradual that plants as well as animals had time to escape by extending their ranges southward, and during the return movement were enabled to keep pace with its slow retreat. Had either the process of refrigeration or the return of heat taken place more rapidly, most of the forms of life inhabiting the northern parts of the globe would have been exterminated. During the recession of the glacier many boreal plants and animals were stranded on mountains, where, by climbing upward as the temperature became warmer, they were able to find a final resting place with a climate sufficiently cool and moist for their needs; here they have existed ever since. This is the commonly accepted explanation of the presence of arctic forms on isolated mountain peaks widely removed from the southernmost limit of their continuous distribution.

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* *The Desert of the* Little Colorado contains but two arid zones; farther south a *third is encountered.*

Incidentally the ancient origin of arctic-alpine faunas leads to conclusions which might be of use to the geologist. For instance, San Francisco Mountain is a volcanic peak composed entirely of lava rock. Its summit is inhabited by species of animals and plants which could not have reached it since the recession of the glacial period. Hence the mountain itself can not be of more recent origin than this period. Here the living fauna and flora afford evidence of the age of a great mountain.

ORIGIN OF THE FAUNA AND FLORA OF THE PAINTED DESERT.

The Desert of the Little Colorado, it will be remembered, is a deep basin on top of the Great Colorado Plateau. It is wholly disconnected from the desert region of southern Arizona by the elevated and timber-covered highlands occupying the crest of the plateau escarpment. In fact the highest part of Arizona south of the Grand Cañon, except a few isolated mountains, is the *edge* of this plateau, which is nowhere below *2,130 meters (7,000 feet), and in* places rises to the height of 2,740 meters (9,000 feet), as at the Mogollon Mesa. On the east, the desert is separated from the valley of the Upper Rio Grande by a broad area covered with cedar and piñon, through which the continental divide passes, at an elevation of upwards of 2,130 meters (7,000 feet). Therefore, the only possible channel through which the fauna and flora of the Painted Desert could have reached this desert during existing climatic conditions is by way of the Grand Cañon of the Colorado. At first thought it seems incredible that a fauna and flora should extend several hundred miles through a chasm of this character; but the evidence at hand indicates that it does. Our descent into the cañon from the Cocanini Plateau was made at a point about 25 kilometers (15 miles) below the mouth of the Little Colorado. Here the cañon is about 1,800 meters (more than a mile) in depth and nearly 25 kilometers (15 miles) wide at the top. Numerous side cañons cut into it, and there are many shelves and bottoms which support a flora of cactuses, yuccas, agaves, greasewoods, and other typical Sonoran forms. Pocket Mice of the sub-genus *Chætodipus*, Large-eared Mice of the *Hesperomys eremicus* group, and the Little Spotted Skunk (*Spilogale*) were secured, together with several birds (among them *Peucæa ruficeps boucardi*) and reptiles of the Sonoran fauna, some of which occur also on the Painted Desert.*

The inference is that the life of the Painted Desert is derived from the deserts of western Arizona, and that it came by the roundabout way of the Grand Cañon of the Colorado.

It might be urged that the climate of the Plateau region in the past may have been enough warmer than at present to admit of direct communication between the life of the Painted Desert and that of the deserts of southern Arizona; but Major C. E. Dutton, who has made a special study of the physiographic history of the Plateau region, assures me that its climate has not been warmer than now since glacial times.

GENERALIZATIONS CONCERNING THE DISTRIBUTION OF LIFE IN NORTH AMERICA.

OVERTHROW OF THE SO-CALLED 'CENTRAL PROVINCE' OF NATURALISTS.

The region almost universally recognized by recent writers as the 'Central Province' is made up of the Great Plains, the Rocky Mountains, and the Great Basin. A critical study of the life of the Rocky Mountains has shown it to consist of a southward extension of the Boreal Province, with an admixture of southern forms resulting from an intrusion or overlapping of representatives of the Sonoran Province, some of which, from long residence in the region, have undergone enough modification to be recognized as distinct subspecies or even species. A similar analysis of the life of the Great Plains and Great Basin has shown them to consist of northward extensions of the So-

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*Among the reptiles found near the bottom of the cañon were two lizards (*Sceloporus clarkii* and *Uta symmetrica*) which belong to the torrid fauna of southern and western Arizona, and are not known to reach the Painted Desert.

noran Province, somewhat mixed with the southernmost fauna and flora of the Boreal Province. Thus the whole of the so-called 'Great Central Province' disappears.

This explains a multitude of facts that are utterly incomprehensible under the commonly accepted zoological divisions of the country. These facts relate particularly to the distribution of species about the northern boundaries of the supposed Central and Pacific Provinces, and to the dilemma we find ourselves in when attempting to account for the origin of so many primary life areas in a country where there are no impassable physical barriers to prevent the diffusion of animals and plants.

EVIDENCE ON WHICH THE 'CENTRAL PROVINCE' WAS BASED.

The conclusions here announced are so diametrically opposed to the long-accepted and current views of zoologists that it may be interesting to examine for a moment the evidence on which their generalizations were based. This evidence, stated briefly, consists in the presence, in the region in question, of a large number of genera and species not found in the Eastern States. It has just been shown that the vast majority of these forms were derived from the north or from the south. The remainder fall naturally into two categories: (1) Those so closely related to forms now living in adjoining regions as to leave no doubt that they are the immediate descendants of the same, modified by environment; and (2) isolated generic types, of which the number is small.

SIGNIFICANCE OF ISOLATED TYPES.

The presence of isolated types, however few, might be regarded as an obstacle to the acceptance of the views here advanced, but their significance becomes apparent as soon as an attempt is made to trace the life of the present back to the life of the past. The colonies of big trees and redwoods of California (*Sequoia gigantea* and *S. sempervirens*) have no nearer relatives than the bald cypress (*Taxodium*) of the Gulf States and a related species from China (formerly recognized generically under the name *Glyptostrobus*). This was pointed out many years ago by Dr. Asa Gray in connection with the circumstance that the ancestors of these trees once ranged throughout the boreal regions of the world. A fossil species (*Sequoia langsdorfii*) closely related to the California redwood has been found in Spitzbergen, Iceland, Greenland, the north of Europe, Alaska, at the mouth of the Mackenzie River, and also in the Rocky Mountains, the Great Basin in Oregon, and the Bad Lands in Dakota. Many parallel cases might be cited. Thus the records of the rocks show that many of the types which have survived the perils incident to the successive shiftings of the fauna and flora during and subsequent to the ice age were formerly conspicuous over large areas in the north. These facts are in complete accord with a general law which may be thus formulated:

When the physiographic conditions of a region are in process of change, *those forms of life which are sufficiently plastic to adapt themselves to the rapidly changing conditions survive, while those which cannot so adapt themselves become extinct.*

Isolated generic types are illustrations of this law and may be regarded as remnants of the past—the only living representatives of types once abundant and widely diffused. Such types are not confined to plants, but may be found in nearly every branch of the animal kingdom. Among North American mammals the genera *Neurotrichus* and *Aplodontia* may be cited as examples, both of them being confined to a narrow strip along the Pacific coast from northern California to British Columbia. The former has a near relative in Japan (*Urotrichus*), and the intermediate forms which connect it with the Shrews on the one hand and the Moles on the other are still living in eastern Asia (the genera *Scaptonyx* and *Uropsilus*). *Aplodontia* is a large rodent, the type and sole representative of an isolated family, and has no known living relative in any part of the world.

PRINCIPAL LIFE REGIONS OF NORTH AMERICA.

[See map 5.]

The most important generalization arrived at in the present investigation is that the whole of extratropical North America consists of but two primary life regions, a *Boreal* region, which is circumpolar; and a *Sonoran* or *Mexican table-land* region, which is unique.*

The *Boreal Province* [colored green on map 5] extends obliquely across the entire continent from New England and Newfoundland to Alaska, conforming in direction to the trend of the northern shores of the continental mass. It gives off three long arms or chains of islands which reach far south along the three great mountain systems of the United States—a western arm in the Cascades and Sierra Nevada, a central arm in the Rocky Mountains, and an eastern arm in the Alleghanies—and these arms interdigitate with northward prolongations of the Sono-

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*Since the present paper was written (December, 1889) the author has been engaged in the preparation of an historical synopsis of the attempts that have been made to define the faunal and floral areas of North America. In the course of this investigation several important papers have been found which confirm, and in part anticipate, the general conclusions here announced, though none of them attempt to explain the significance of the areas recognized or to correlate them with the northern and southern origin of the life of the continent. For instance, the late Dr. Asa Gray stated that it is certain "that two types have left their impress upon the North American flora, and that its peculiarities are divided between these two elements. One we may call the *boreal-oriental element*; this prevails at the north, and is especially well represented in the Atlantic flora and in that of Japan and Manchuria; the other is the *Mexican-plateau element*, and this gives its peculiar character to the flora of the whole southwestern part of North America, that of the higher mountains excepted" (Bull. U. S. Geol. and Geog. Survey, VI, 1, Feb. 11, 1881, 62). At the same time, and in the same communication, Dr. Gray adopts the three great divisions usually recognized by zoologists—Eastern, Central, and Pacific.

ran Province, which latter completely surround the southern islands of the Boreal system.

The *Sonoran Province* [colored orange or yellow on map 5] comes into the United States from the south and is divisible into six subregions, namely: (1) an *Arid* or *Sonoran* subregion proper, occupying the tableland of Mexico and reaching north into western Texas, New Mexico, Arizona, and southern California; (2) a *Californian* subregion, occupying the greater part of the State of that name; (3) a *Lower Californian* subregion; (4) a *Great Basin* subregion, occupying the area between the Rocky Mountains and the Sierra Nevada and extending as far north as the Plains of the Columbia; (5) a *Great Plains* subregion, occupying the plains east of the Rocky Mountains and extending north to the Plains of the Saskatchewan; and (6) a *Louisianian* or *Austroriparian* subregion, occupying the lowlands bordering the Gulf of Mexico and the Mississippi, and extending eastward, south of the Alleghanies, to the Atlantic seaboard, where it reaches as far north as the mouth of Chesapeake Bay.

The latter region requires a word of comment, since its true affinities have not been heretofore pointed out, though the region itself has been long recognized.* That it is an offshoot of the Sonoran region is evident from the fact that most of its peculiar or distinctive animals and plants belong to Sonoran genera, and many of its species are identical with or closely related to Sonoran forms. It contains no less than eight Sonoran genera of mammals, namely: *Spilogale*, *Urocyon*, *Neotoma*, *Sigmodon*, *Ochetodon*, *Geomys*, *Plecotus* (subgenus *Corinorhinus*), and *Nyctinomus*, most of which extend northward near the Atlantic seaboard as far as Norfolk, and at least one of them (*Urocyon*) considerably further. It contains also a number of Sonoran genera of birds, reptiles, batrachians, and plants. At the same time, it contains two Tropical American genera of mammals, namely, *Didelphys* and *Oryzomys*; and perhaps *Urocyon*, *Sigmodon*, and *Nyctinomus* belong as much to one as to the other. It contains also a number of Tropical genera of birds, reptiles, and plants. Hence the *Austroriparian* subregion consists of a mixture of Sonoran and Tropical forms; but since the number of its Sonoran types is greatly in excess of the Tropical, it may be fairly regarded as a subdivision of the former.

The *Tropical Province* [colored red on map 5], so far as North America is concerned, occupies Central America and the Antilles and pushes north along the lowlands on both sides of Mexico, reaching the mouth

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*As early as 1817 the entomologist Latreille made it one of his circumpolar divisions. In 1822 the botanist Schouw named it the *Realm of Magnolias*; and in 1854, Agassiz named it the *Louisianian Fauna*. These authors, and several other early writers (including Meyen, Martius, Berghaus, and Schmarda) regarded it as a region of primary rank. More recent writers (including LeConte, Cooper, Binney, Baird, and Allen) looked upon it as a subdivision of the eastern forest region or *Eastern Province*. Cope, in 1873, restored it to independent rank and named it the *Austroriparian region*.

of the Rio Grande on the Gulf of Mexico, and a little north of Mazatlan on the Pacific coast. It occupies also a narrow belt encircling the southern half of the peninsula of Florida. This tropical element in Florida is of comparatively recent origin, and consists mainly of a chain of island-like colonies of birds, insects, and plants which may easily have reached its shores and keys from the neighboring West Indies, as pointed out by Schwarz in an article on its peculiar Insect Fauna (Entomologica Americana, IV, No. 9, 1888). The interrelations of the Tropical and Sonoran Provinces are such as suggest that the chief difference may be due to humidity as much as temperature.

In the light of the general conclusions here announced, the only part of North America which is in any way obscure, so far as the relationships of its faunas and floras are concerned, is the so-called '*Pacific Province;*' and, like the '*Central Province*' already discussed, it is evidently made up of two distinct elements, a *mountain* element derived from the Boreal Province, and a *valley* element derived from the Sonoran; but owing to the peculiar physiographic conditions of the west coast it has undergone a greater amount of differentiation.

CAUSES WHICH DETERMINE DISTRIBUTION.

It is not the purpose of the present paper to discuss the causes that have to do with limiting the distribution of terrestrial animals and plants further than to point out a generalization which seems to have been overlooked. Omitting reference to the effects of physical barriers, which explain the differences in the life of disconnected continents, it may be stated that temperature and humidity are the most important causes governing distribution, and that temperature is more potent than humidity.* Authors differ as to the period during which temperature exerts the greatest influence, some maintaining that it is the temperature of the whole year, and others, that it is the temperature of a very brief period which determines the range of species. In the case of birds, it has been shown by Verrill and Allen that it is the temperature of the *breeding season.*

If this is true of birds, why is it not true of other forms of animal life and of plants as well? The season of reproduction for the plant, as for the animal, is the warm part of the year. After the period of reproduction the plant withers; after it flowers and fruits and matures its seed, it dies down or becomes physiologically inactive. And what the plant accomplishes in one way the animal accomplishes in another. To escape the cold of winter and its consequences the sensitive mammal hibernates; the bird migrates to a more southern latitude; the reptile and batrachian dig holes in the mud or sand and remain in a torpid condition; the insect sleeps in its cocoon or buries itself under leaves

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*In arid districts humidity is an element of vastly more consequence that in re*gions of moderate* or copious rain-fall, particularly in regard to the inception of the *period of reproduction* in plants.

or decomposing vegetation; and none but the hardier forms of life are left to be affected by winter temperatures. Freezing does not hurt most plants when not in a state of reproductive activity. In the north, trees five and six feet in diameter freeze through to the heart every winter. It is obvious, therefore, that plants are not exceptions to the law that *the temperature during the season of reproductive activity* determines the distribution of life. In high arctic latitudes this period is very brief, while in the humid parts of the tropics it seems to extend over nearly if not quite the whole year.

Some eminent writers have assumed that plants and animals do not agree in distribution—that a faunal map (a map showing the distribution of an association of animals) must differ essentially from a floral map (a map showing the distribution of an association of plants). This assumption is illogical, for, as just stated, plants and animals are subjected to the same conditions during the season of reproduction—the season during which they are most affected by their surroundings. Furthermore, the field work on which the present paper is based, which was conducted with special reference to the determination of this point, demonstrated that complete coincidence exists in the limitation of the life-areas as defined independently by the study of the mammals, birds, reptiles, and plants of the San Francisco Mountain region.

Since the distribution of animals and plants depends primarily upon temperature, it follows that the physiographic conditions which influence temperature influence distribution also. In obedience to this law certain axioms of distribution may be thus expressed:

The distribution of species *in the same latitude* depends primarily on *altitude*.

The distribution of species in the same latitude and altitude is influenced notably by—
- (*a*) Elevation above base-level.
- (*b*) Slope-exposure.
- (*c*) Proximity to and direction from large bodies of water.
- (*d*) Meteorologic conditions affecting temperature.

In the case of mountains of equal altitude and low base-level:
- (1) The number of faunal and floral zones (up to the limit of zones possible for the range of temperature) is inversely proportional to the distance from the equator.
- (2) The width of the zones and the abruptness of the change from one to another is proportional to the steepness of the slope.

By elevation above base-level is meant the height of a given point above the plane it faces. This may be made clearer by an example. The mean altitude of base-level below the plateau rim in Arizona is less than 900 meters (3,000 feet), and above it more than 2,130 meters (7,000 feet). A mountain standing on the edge of the plateau will have a higher temperature at a given altitude on the north side than on the south side, because the plateau level (base-level) on the north side carries up the temperature. Many years ago Humboldt cited an instance of this kind in the Himalaya. The temperature on the north side of this lofty range is much higher than on the south side at the same elevation; or, to state it differently, the snow line and the timber line on the north side are about 900 meters (3,000 feet) higher than on the south side. This is due to the great height of the Thibetian Plateau as compared with the altitude of base level on the south side, and is in opposition to the influence of slope-exposure. By slope-exposure is meant the inclination of the surface of the earth in relation to the angle of reception of the sun's rays. The sun strikes the east side of a hill or mountain in the early part of the day, the south side a little later, the southwest and west sides in the afternoon, when its heat is greatest, and the northwest and north about sundown or not at all. But in case there is a high plateau on the north side, the heat from the plateau will force the timber line up. Therefore, of the influences under consideration, base-level is more powerful than slope exposure.

About half a century ago the elder Binney, in a work which he did not live to see published, made the following observation:

"The relations which the different levels of elevation bear to the parallels of latitude, although as interesting to the zoologist as to the botanist, have not yet been made the subject of examination in this country. But the Rocky Mountains * * * offer, in the great extent of their table-land and in the height to which they rise, a vast field of research to future naturalists, where they will be able to solve many of the most important questions connected with the geographical distribution of the terrestrial mollusks of our country."[*]

If the word 'mollusks' in the above quotation be changed to the more comprehensive word 'life,' Binney's remarks may be regarded as a prophecy fulfilled, in part at least, by the present Biological Survey of San Francisco Mountain. At the same time it should be remembered that the present report is little more than an announcement of the general conclusions resulting from a brief survey of a limited area, and that anything approaching a final discussion of the subject must be deferred until similar surveys of many regions result in the accumulation of a multitude of facts now unknown. As the late Leo Lesquereux once said of his favorite study:

"This science is in its infancy; and the childhood of science is marked, like that of man, by a series of trials and failures, from which strength and proficiency are derived. The first astronomers did not measure the distance from the earth to the fixed stars, nor weigh the planets by the diameter of their orbits."[†]

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[*] Amos Binney, The Terrestrial Mollusks of the U. S., 1851, vol. 1, 116–117.

[†] *A Review of the* Fossil Flora of North America. Bull. U. S. Geol. and Geog. Survey *Terr., No. 5* (2d series) Jan., 1876, 248

LIMATE OF THE SAN FRANCISCO MOUNTAIN REGION AND DESERT OF THE LITTLE COLORADO, ARIZONA.

The traveler in the Plateau region of Arizona is awed by the grand-ar and energy with which the processes of nature manifest themselves. he multitude of volcanic craters and lava cones, culminating in San rancisco Mountain, attest the former activity and intensity of the sub-rranean forces; the Grand Cañon of the Colorado, the most stupen-ous chasm known, is a gigantic illustration of the surface forces now in eration—of the cutting power of water and the carving power of ind; while the terrific thunder-storms and cloud-bursts which shake e very foundations of the earth in their fury, shattering the tall pines ith the lightning, and sending mighty torrents down the hillsides to ow deep gorges in the desert, serve to indicate the resistless energy ' the forces of the air.

In its climatological aspects the Plateau region of Arizona presents a ld of surpassing interest and diversity, and problems of the utmost portance to physiography and to agriculture may be there advanta-ously studied. Climates which usually characterize widely remote gions are here brought near together, appearing in successive strata om the desert levels to the summits of the mountains, thus permitting eir several effects to be comprehended at a glance, and their differ-ces contrasted. In a general way it may be said that the climate of e region abounds in extremes. Protracted periods of drought are in-rrupted by deluges of rain; and the snows of winter suddenly give ace to the intense heat of summer. As a natural consequence, most ' the mammals and all of the reptiles and batrachians hibernate for nger or shorter periods, even on the desert.

It is not the purpose of the present essay to discuss meteorologic nditions further than is necessary to indicate in a very general way e peculiarities of temperature and humidity which characterize the veral zones herein defined.

TEMPERATURE.

The tropics are characterized by great uniformity of temperature, the ily and yearly fluctuations being insignificant. The absence of a arked fall in temperature at night is due in great part to the large antity of moisture in the atmosphere. This moisture acts in two ys: (1) by diminishing the loss of heat by radiation; (2) by directly creasing the temperature of the atmosphere. As stated by Wallace, the warmth given off by the heated earth is very largely absorbed by [the aqueous vapor], thus raising the temperature of the air; and as is the lower strata of air which contain most vapor, these act as a anket to the earth, preventing it from losing heat at night by radia-n into space." (*Tropical Nature*, 1878, p. 9.)

The excessively dry atmosphere of Arizona acts in exactly the opposite way, interposing no obstacle to free radiation and presenting no medium to retain the heat given off at night. Hence the change in temperature from day to night is always great. The summer heat of Arizona, except on the high mountains, is greatly in excess of the summer heat of the tropics, while the winter temperature is vastly lower, and sudden contrasts are common.

The law of latitudinal equivalent in altitude was discovered in the last century and was early formulated by Humboldt. Omitting reference to local disturbing influences and seasonal variations, it may be stated as a general proposition that temperature decreases from the equatorial zone to the poles at an average rate of a little less than 1° Fahr. for each degree of latitude; and from base-level to higher altitudes, at the average rate of about 3° Fahr. for each 1,000 feet of elevation. In temperate and cold regions the differences due to latitude and altitude are greatest in winter and least in summer. It follows that places having the same mean annual temperature may have widely different summer temperatures; and conversely, that places receiving the same amount of summer heat may have widely different mean annual temperatures. The significance of these facts becomes apparent in studying the distribution of life, for, as will be shown later, the distribution of species in temperate and cold regions is governed in the main by the temperature of the warm season, the mean annual temperature being of little consequence.

It has just been stated that the mean average decrease in temperature with altitude is about 3° Fahr. for each 1,000 feet. The exact rate in any particular case may be obtained by dividing the difference in temperature of the extremes by the difference in altitude. The Signal Service records show that the actual rate of decrease in midsummer on the Colorado Plateau is 4°.[*] At this rate the temperature of the summit of San Francisco Mountain in summer would be 20° Fahr. lower than that of the cedar belt and 35° lower than that of the Painted Desert.

Seven life zones are described in the following pages as crowded into the narrow space between the arctic-alpine summit of San Francisco Mountain and the torrid desert of the Little Colorado, only 40 kilometers (about 25 miles) distant. Each of these zones has a distinctive temperature during the period of growth and reproduction—a period of less than three months' duration at the summit, but extending over half the year on the desert. Unfortunately, the time spent in any one of the several zones was insufficient to furnish the thermometric data necessary for the determination of its distinctive temperature. Therefore the only way in which it is possible to obtain information on this subject is by examination of the records of the nearest stations in the same or corresponding zones. Data from several such stations may be found in the publications of the United States Signal Service and in Schott's Tables, published by the Smithsonian Institution.* Compilation of these data leads to interesting results. Fort Apache, in Arizona, and Fort Wingate, just over the line in New Mexico, are in the piñon belt of the Great Plateau, Apache near the lower, and Wingate near the upper, limit of this zone. They are 232 kilometers (145 miles) apart. The mean temperature for the five months (April to August, inclusive), assumed to cover the period of reproduction in this belt is found to be 65.6° Fahr. at Fort Apache, and 65.03° at Fort Wingate, showing a really remarkable agreement over this part of the piñon belt. The mean temperature of the same period at Holbrook, on the edge of the Little Colorado Desert (at the junction of the Puerco and Little Colorado), 124 kilometers (77 miles) from Fort Apache, is a little above 70° (70.9°) Fahr. Albuquerque, in the valley of the Upper Rio Grande in New Mexico, though on the other side of the Continental Divide and 309 kilometers (192 miles) distant, has essentially the same altitude and essentially the same summer temperature (70.1° Fahr.).

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[*] Denver and Pike's Peak were selected for this computation because of their proximity to the San Francisco Mountain region and because they afford a vertical range of about 2,450 meters (8,000 feet).

Data are wanting for the determination of the distinctive temperatures of the several zones of San Francisco Mountain above the cedar and piñon belt, but they may be obtained hypothetically by substituting those from remote stations in the same zones. For instance, the temperature of the summit of Mount Washington, in the timber-line or subalpine zone of the east, during the season of reproduction (June to August, inclusive), is 46.15° Fahr., which may be assumed to agree very closely with the temperature of the subalpine zone of San Francisco Mountain. Similarly, the corresponding temperature of Pike's Peak, Colorado, in the arctic-alpine zone, is 38.23° Fahr. But Pike's Peak is more than a thousand feet higher than San Francisco Peak, hence it is necessary to add about 4° Fahr. to the temperature of the former to make it represent that of the latter, which would then be in round numbers 42° Fahr.

Therefore, though the actual mean temperatures of the several zones of the San Francisco Mountain region during the season of reproduction are unknown, it is possible to arrive at very close approximations to these temperatures by utilizing the records from distant stations in the same life areas. By this process the following means have been obtained. While not supposed to represent the actual means for each zone, they are believed to fall within the normal range of variation between the upper and lower borders of the zones to which they severally pertain, and are therefore provisionally submitted as a step toward a goal as important as it is difficult to attain.

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*The observations here referred to were taken at different periods and by voluntary observers. They lack, probably, the extreme precision and uniformity attained by the trained observers of the Signal Service; at the same time, most of them may be relied upon as sufficiently exact for purposes of comparison.

Table of assumed mean temperatures for the several zones during the period of reproduction.

Zone.	Cent.	Fahr.
	°	°
Arctic-alpine zone	4	39.2
Subalpine or timber line zone	7	44.6
Hudsonian or spruce zone	10	50.
Canadian or fir zone	13	55.4
Neutral or pine zone	16	60.8
Piñon or cedar zone	19	66.2
Desert zone	22	71.6

In attempting to ascertain the temperature of climatic zones, in connection with the distribution of their characteristic forms of life, it should be borne in mind that the recorded temperatures are taken *in the shade*, while the plants and diurnal animals of non-forested areas, particularly of deserts and prairies, *live in the sunshine*, and consequently endure much higher temperatures, as well as much greater extremes than indicated by the recorded observations. In attempting, therefore, to ascertain the quantity of summer heat necessary for a particular species, it should be first noted whether the species inhabits areas exposed to the full heat of the sun or dense forests where the sun's rays rarely penetrate; and in the case of animal life it should be noted also whether the species is diurnal or nocturnal, and the temperature observations should be made accordingly.

A series of carefully conducted meteorologic observations, made with special reference to temperature and humidity, and carried on simultaneously in the spruce belt of the mountain and on the Painted Desert, or, better still, in each of the seven zones herein defined, would be productive of information of much scientific and economic value.

HUMIDITY.

The Plateau region of the interior of North America is noted for its scanty rain-fall, and the same may be said of Arizona as a whole. The annual precipitation and mean humidity are greatest on the high mountains and least on the low plains and deserts. Thus San Francisco Mountain has many times the rain-fall of the Little Colorado Desert, near by, and the quantity of aqueous vapor in the air is correspondingly higher. Evaporation is retarded by the clouds which frequently rest upon the summit, and by the dense spruce forests which protect the soil from the direct rays of the sun, enabling it to retain enough moisture to permit the growth of plants requiring a humid atmosphere for their existence.

There are two rainy seasons on the San Francisco Mountain plateau: ne in summer, usually in July or August, the other in mid-winter. he summer rainy season is characterized by daily thunder-showers. s a rule, several such showers occur each day, and not infrequently veral may be seen at the same time from any of the volcanic cones. he area covered by each is very small, its diameter rarely exceeding lf, or even a quarter of a mile; and its duration is brief, though the in-fall may be considerable. The accompanying thunder is often rific, and the lightning vivid and destructive. Tall pines are shat- ed on every hand, and cattle are frequently killed; three were killed one stroke near our camp about the middle of August. The showers nost always take place in the day-time, and are most common at mid- y and in the early afternoon. In fact, it is a common saying in this gion that it never rains at night. Two partial exceptions to this rule curred during our stay, one in which an unusually severe and pro- cted rain lasted from about 3 o'clock in the afternoon until 9 or 10 in e evening; the other, a light shower which actually took place in the ght. During the latter part of the rainy season the showers became s frequent, but extended over a larger area and lasted longer. The is of abundance seems to be between San Francisco and Kendrick aks, but the greatest precipitation occurs on San Francisco Mountain, would be expected from its great altitude. The summit of the mount- n is so cold that it is occasionally whitened with snow while rain falls its base; and hail storms are frequent both on the mountain itself d throughout the plateau region, many sudden storms taking this rm.

Over much of the pine plateau the soil consists of decomposed lava, d is so porous that the rain sinks out of sight as it falls, and the nosphere is so dry and evaporation so rapid that a few minutes after shower no traces of it are visible.

On the arid desert of the Little Colorado rains are infrequent, but ually of great violence, producing torrents which cut deep washes or royos' in the sun baked sand and clay. Sometimes cloud-bursts luge large areas, flooding the valleys and destroying multitudes of e smaller mammals. Three storms of this character were witnessed, o of moderate size, the third of great dimensions, and striking evi- nces of a fourth were everywhere noticeable when we reached the gion. This latter almost inundated the town of Flagstaff and several er places along the line of the Atlantic and Pacific Railway, and t unmistakable evidences of its volume and force in various directions, e most impressive, perhaps, being the overflow of a crater lake and joining craterlet just east of Kendrick Peak. The track of the torrent at rushed down the sides of this crater, and for a distance through e pine forest beyond, suggested a veritable volcanic eruption.

While following the course of Tenebito Wash across the Painted sert we saw a *heavy rain-storm* raging over the high mesas to the north and east during the entire afternoon of August 14, though not a cloud came between us and the parching sun. Before dark a furious wind—the vehicle of a sand-blast—swept down the wash between the rows of cliffs which mark its course, abating as night came on. About 10 o'clock we were startled by a loud roaring in the north, which at first gave the impression that a severe storm was advancing upon us, but not a cloud could be seen, and the stars shone brightly in every direction. The roaring increased and came nearer until it was evident that something was coming down the bed of the wash; and in a moment a great wave of thick mud rushed past with a tremendous roar, accompanied by a fetid stench. The first wave was about 1½ meters (5 feet) high, but it soon rose to 2½ meters (8 feet), where it remained for an hour, and then slowly subsided. After 3½ hours it was still about 1½ meters (5 feet) deep and running swiftly, and it had not entirely ceased three days later.

Two days afterward (August 16), when at the Moki Pueblo of Oraibi, a furious rain set in about 4 p. m., and lasted more than an hour, flooding the house tops and streets, and parts of the valley below. And yet the desert was as parched next day as if it had never been wet.

The heaviest and most extended rain-fall observed by us occurred September 20, on which date Mr. Bailey and I set out from Little Spring for Moencopie. Heavy leaden clouds began scurrying over the mountain toward the northeast early in the morning, and by noon the entire sky was overcast and had a most ominous appearance. Soon the rain began falling in torrents, and the storm moved steadily eastward from the edge of the lava beds to the Little Colorado, and thence across the desert to the high mesas beyond. Such a deluge I never saw, and we afterwards learned that it extended 160 kilometers (nearly 100 miles) to the south. The gulch in the edge of the lava beds, about 2½ kilometers (1½ miles) east of Black Tank, was full to overflowing; the flat upon which it empties was 1½ meters (5 feet) under water; great lakes appeared in various parts of the desert, and the Little Colorado bottom was completely flooded. And yet all this vast volume of water disappeared in a few hours. A red, sirupy, alkaline mud filled the bed of the Little Colorado for a few days, and pools of similar mud were occasionally found in depressions in the sand-rock all the way to Moencopie. The whole desert, from the San Francisco lava beds on the west to Echo Cliffs on the east, showed that it had been recently deluged, as if by the breakage of some mighty dam, but the water had disappeared.

From the scanty data available, and from the experience of residents of the region, it is safe to infer that the rain-fall was unusually heavy in the Plateau region during the summer of 1889.

PART II.—GRAND CAÑON OF THE COLORADO, BETWEEN THE KAIBAB AND COCANINI PLATEAUS.

No attempt will be made to define or describe the faunas and floras of the stupendous chasm of the Colorado. Our stay of five days permitted only a hurried reconnoissance, which serves to indicate merely in a general way the more conspicuous features of the region.

The lowest point between San Francisco Mountain and the Grand Cañon is at the end of a narrow arm of the desert near Hull Spring, where the junipers and piñon which border this tongue of desert unite and extend westward in a broad belt, completely separating the pine forest of the mountain plateau from that of the Cocanini Plateau (as shown by the areas colored yellow and green on Map 1). While the San Francisco Mountain Plateau is composed of lava, the Cocanini Plateau is carboniferous limestone. The resulting difference in soil affects the vegetation, and many plants grow in the piñon belt at the cañon which are not found in the same belt on the lava. Among such plants are *Cowania mexicana*, *Berberis fendleri*, *Spiræa millefolium*, *Robinia neomexicana*, and *Yucca baccata*. *Juniperus californicus utahensis* grows here also, but the relation of its presence to the soil is uncertain. The true sage-brush (*Artemisia tridentata*) of the Great Basin here finds its extreme southeastern limit. Large patches of it occur on the south side of the cañon, opposite Point Sublime, but it disappears altogether a few miles away.

At the brink of the cañon opposite Point Sublime, about 2 miles east of the pool or tank known as Cañon Spring, is a dwarf forest of peculiar aspect, and having a uniform height of about 5 meters. It consists of piñon (*Pinus edulis*), cedar (*Juniperus californicus utahensis*), and mountain mahogany (*Cercocarpus ledifolius**), which here equals the juniper and piñon in height and measures 100 to 200 millimeters (approximately 4 to 8 inches) in diameter. Mingled with it are numerous tall bushes of *Berberis fremonti* and the beautiful *Spiræa millefolium*. In places this Lilliputian forest merges into extensive fields of the true sage-brush (*Artemisia tridentata*) and yucca (*Yucca baccata*, which at the time of our visit was ripening its sweet, banana-like fruit), with several kinds of cactuses; while in other directions it gives place to thickets of scrub oak (*Quercus gambeli*), with here and there a small patch of dwarf locust (*Robinia neo-mexicana*).

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*This identification was made in the field. No specimens of the large form were brought back, but specimens of a smaller bush from the Cañon prove to be Cowania mexicana.

The Cocanini Plateau is highest on the north and rises abruptly at the very rim of the cañon. The resulting southern slope is enough warmer than the pine-covered plateau to permit the growth of juniper and piñon, which besides forming a strip along the edge of the cañon, mingle with the pines below to a limited extent. The descent into the cañon is precipitous, the walls being vertical or even overhanging for the first 300 meters (1,000 feet), so that tree growth is impossible except in favored spots. In places where the cliff is broken down or cut into by side cañons a sparse forest of conifers maintains a precarious foothold.

The Grand Cañon is about 354 kilometers (220 miles) in length, and its proportions are on too vast a scale to be comprehended by those who have not seen it. At the point visited, it is about 1,800 meters (6,000 feet) in depth and 25 kilometers (15 miles) wide at the top. It is intersected by gulches and side cañons of gigantic dimensions. It has ledges, terraces, and mesas, barren crags and grassy slopes, lofty mountains and deep valleys, cool hillsides clad in forests of balsam firs, and hot bottoms filled with sub-tropical thickets; it has arid stretches of sand bearing a scattered growth of cactus and yucca, and marshes and springs that never become dry and are hidden by the verdure of a multitude of plants requiring a moisture-laden atmosphere for their existence. Its animal life is as sharply varied and as strangely contrasted.

In descending from the plateau level to the bottom of the cañon a succession of temperature zones is encountered equivalent to those stretching from the coniferous forests of northern Canada to the cactus plains of Mexico.* They result from the combined effects of altitude and slope-exposure, the effects of the latter being here manifested in an unusual degree. Where the walls of the cañon face north or northeast the uppermost tree-zone consists of Douglas and balsam firs (*Pseudotsuga douglasii* and *Abies concolor*)—northern species which do not occur elsewhere in the cañon. Below this is a belt of pines (*Pinus ponderosa*), succeeded in turn by a belt of junipers and piñon, usually more or less mingled with pines. Immediately below the piñon belt is a zone which corresponds in the main to the Desert of the Little Colorado; but since it has humid as well as arid areas, forms of vegetation unknown on the desert interrupt its stretches of cactuses, yuccas, and greasewoods. Still lower down another zone is encountered which may be recognized by the presence of huge cactuses, arborescent opuntias, agaves whose tall stems are conspicuous land-marks, and many other plants characteristic of the Lower Colorado and Gila regions, together with sub-tropical humid forms and a certain percentage of species not found elsewhere. The complex and interacting effects of radiation and refraction, of aridity and humidity, of marked differences in temperature at places of equal altitude on opposite sides of the cañon, of every possible angle of slope exposure, and of exposure to and protection from winds and storms, produce a diversity of climatic conditions the effect of which on the animal and vegetable life of the cañon has been to bring into close proximity species characteristic of widely separated regions, and to crowd the several life zones into narrow parallel bands along the sides of the cañon—bands which expand and contract in conforming to the ever-changing surface. The same conditions modify and alter the species there present in the manner in which the evolution of new species is brought about. In short, the Grand Cañon of the Colorado is a world in itself, and a great fund of knowledge is in store for the philosophic biologist whose privilege it is to study exhaustively the problems there presented.

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* The extremes of temperature are well illustrated by the fact that the lowest temperature of the twenty-four hours at the bottom of the cañon was 80° Fahr. at *4 a. m., September* 13, while at the same time thick ice formed on a bucket of *water at the top* of the cañon.

LIST OF MAMMALS NOTED AT THE GRAND CAÑON OF THE COLORADO, ARIZONA, SEPTEMBER 10 TO 15, 1889.

[The new species here mentioned are described in Part III.]

Vesperugo fuscus. Large Brown Bat.

Tolerably common; a few were seen nearly every evening.

Vesperugo hesperus. Pigmy Bat.

Abundant. These bats inhabit crevices in the cliffs and begin to fly before dark in the evening, at which time swarms of them come up over the brink of the cañon and flit about among the pines and piñon.

Sciurus aberti. Abert's Squirrel.

Tolerably common in the pines; a few were found feeding on piñon nuts along the brink of the cañon.

Tamias dorsalis. Gila Chipmunk.

Common among the cliffs along the top of the cañon, but excessively shy and difficult to procure.

Spermophilus grammurus. Rock Squirrel.

Abundant among the piñon along the brink of the cañon, living in holes in the rocks.

Hesperomys leucopus sonoriensis. White-footed Mouse.

Not common; two specimens provisionally referred to this form were caught along the top of the cañon, and one was killed in the day-time in a field of sage brush (*Artemisia tridentata*).

Hesperomys eremicus. Silky Cliff Mouse.

Abundant both along the cliffs at the top of the cañon and thence down to the river below. This is the most abundant mammal of the cañon.

Hesperomys megalotis sp. nov. Leaf-eared Cliff Mouse.

A single specimen was caught in the cliffs at the brink of the cañon.

Neotoma mexicana. Wood Rat.

Common both in the cañon and along the cliffs at the top.

Thomomys fulvus. Pocket Gopher.

Tolerably common wherever there is enough suitable soil on the plateau at the top of the cañon.

Perognathus (Chætodipus) intermedius. Pocket Mouse.

Common in small colonies down in the cañon.

Lepus texianus. Jack Rabbit.

This species inhabits fields of sage-brush near the cañon, coming up from the desert of the Little Colorado.

Lepus arizonæ. Arizona Cotton-tail.

Tolerably common in the juniper and chaparral.

Cariacus macrotis. Black-tailed Deer.

Three were killed by a sheep herder near the cañon during our stay.

Antilocapra americana. Antelope.

Said to be not rare near the cañon.

Ovis canadensis. Mountain Sheep.

Tolerably common; we saw fresh signs nearly every day, and started a small herd opposite Point Sublime.

Felis concolor. Mountain Lion.

Said to be tolerably common and destructive to sheep.

Lynx baileyi sp. nov. Plateau Wildcat.

Tolerably common.

Canis latrans. Coyote,

Common; many tracks seen. The sheep herders say that they lose many lambs through the depredations of Coyotes.

Spilogale gracilis sp. nov. Little Striped Skunk.

Common both in the cañon and among the cliffs at the top.

Bassaris astuta. Ring-tailed Bassaris.

Said to be abundant in Cataract Cañon and at places in the Grand Cañon.

LIST OF BIRDS NOTED AT THE GRAND CAÑON OF THE COLORADO, ARIZONA, SEPTEMBER 10 TO 15, 1889.

Zenaidura macroura. Mourning Dove.

A few were seen in the pines and piñon.

Cathartes aura. Turkey Vulture.

Common; as many as fifteen were seen at one time sailing over the cañon, and a number were observed circling over a flock of sheep near Hull's Ranch.

Accipiter velox. Sharp-shinned Hawk.

Common; one shot.

Accipiter cooperi. Cooper's Hawk.

Common; these hawks came to the spring every morning during our stay to prey upon the small birds which came there to drink.

Buteo borealis calurus. Western Red-tail.

Common.

Aquila chrysaëtus. Golden Eagle.

One seen.

Falco sparverius. Sparrow Hawk.

Tolerably common; a male was shot whose stomach was full of grasshoppers.

Pandion haliaëtus carolinensis. Osprey; Fish Hawk.

Seen twice.

Bubo virginianus saturatus. Dusky Great Horned Owl.

Tolerably common; two came to the spring to drink about 10 o'clock the night of September 14, and after satisfying their thirst began hooting in the tall pines. One was shot as he started to fly away.

Megascops flammeolus. Flammulated Screech Owl.

I shot a single specimen of this exceedingly rare owl while climbing out of the cañon about 3 o'clock in the morning of September 13. Its stomach contained a scorpion and the remains of insects.

Dryobates villosus hyloscopus. Cabanis's Woodpecker.

A few were seen in the pines.

Sphyrapicus thyroideus. Williamson's Sapsucker.

Tolerably common; adults of both sexes were shot.

Melanerpes formicivorus bairdi. California Woodpecker.

One was shot and several others were seen in the oaks half a mile from the cañon.

Melanerpes torquatus. Lewis's Woodpecker.

Tolerably common; flocks of half a dozen to a dozen came to the spring to drink every day.

Colaptes cafer. Red-shafted Flicker.

Tolerably common.

Micropus melanoleucus. White-throated Swift.

Several were seen in the cañon, but most of them had migrated before the date of our arrival (September 10).

Trochilus platycercus. Broad-tailed Hummingbird.

Tolerably common; shot down in the cañon and seen also at the top.

Tyrannus vociferans. Cassin's King-bird.

Two were seen in the sage-brush and chaparral near the cañon, and a few in the cedars.

Sayornis saya. Say's Phœbe.

Seen in the chaparral and cedars near the cañon.

Contopus richardsonii. Western Wood Pewee.

Tolerably common.

Cyanocitta stelleri macrolopha. Long-crested Jay.

Common; feeding on piñon nuts in company with Woodhouse's and Piñon Jays.

Aphelocoma woodhousei. Woodhouse's Jay.

A few were seen in the piñon near the brink of the cañon.

Corvus corax sinuatus. Raven.

Several were seen along the cliffs at the brink of the cañon.

Cyanocephalus cyanocephalus. Piñon Jay.

Abundant in the piñon near the brink of the cañon and also in the cedar belt; generally seen in flocks of from thirty to eighty.

Carpodacus mexicanus frontalis. House Finch.

Common in small flocks, coming to the tank to drink every day.

Loxia curvirostra stricklandi. Mexican Crossbill.

Common; both sexes were shot at the tank, where they came to drink.

Spinus psaltria. Arkansas Goldfinch.

Small flocks visited the tank to drink every day.

Poocætes gramineus confinis. Western Vesper Sparrow.

Common in all grassy places and in the sage-brush.

Zonotrichia leucophrys. White-crowned Sparrow.

Two were shot.

Spizella socialis arizonæ. Western Chipping Sparrow.

Tolerably common.

Junco cinereus dorsalis. Red-backed Junco.

Tolerably common.

Peucæa ruficeps boucardi. Boucard's Sparrow.

Common in the cañon from an altitude of 4,000 feet downward. Adults and young were shot.

Melospiza lincolni. Lincoln's Sparrow.

Two were shot, and others seen near the brink of the cañon.

Pipilo maculatus megalonyx. Spurred Towhee.

Several were seen in the scrub oak.

Pipilo chlorurus. Green-tailed Towhee.

Abundant along the brink of the cañon.

Habia melanocephala. Black-headed Grosbeak.

Tolerably common.

Piranga ludoviciana. Louisiana Tanager.

An immature bird of this species was shot in the cañon.

Tachycineta thalassina. Violet-green Swallow.

A few only were seen, most of the species having gone south.

Ampelis cedrorum Cedar Waxwing.

A few were seen and one shot at the tank.

Lanius ludovicianus excubitorides. White-rumped Shrike.

Two were seen in the sage and chaparral near the cañon.

Vireo solitarius cassinii. Cassin's Vireo.

Two were shot.

Vireo vicinior. Gray Vireo.

One was shot in a piñon at the brink of the cañon.

Dendroica auduboni. Audubon's Warbler.

Common.

Dendroica nigrescens. Black-throated Gray Warbler.

One was shot.

Dendroica townsendi. Townsend's Warbler.

One was shot.

pis macgillivrayi. Macgillivray's Warbler.

mon in thickets down in the cañon, where two were shot. A few en also along the brink of the cañon.

pis trichas occidentalis. Western Yellow-throat.

was shot low down in the cañon.

tes obsoletus. Rock Wren.

mon along the edge of the cañon.

es mexicanus conspersus. Cañon Wren.

non in the cañon.

rolinensis aculeata. Slender-billed Nuthatch.

ably common.

gmæa. Pygmy Nuthatch.

ıdant in the pines.

ornatus griseus. Gray Titmouse.

ıncommon in the cedars and piñon.

ambeli. Mountain Chickadee.

ably common.

calendula. Ruby-crowned Kinglet.

al were seen and one shot.

la cærulea. Blue-gray Gnatcatcher.

in small flocks near the top of the cañon.

migratoria propinqua. Western Robin.

ably common.

exicana. Western Bluebird.

ıdant at the cañon.

ART III.—ANNOTATED LIST OF MAMMALS OF THE SAN FRANCISCO MOUNTAIN PLATEAU AND DESERT OF THE LITTLE COLORADO IN ARIZONA, WITH NOTES ON THEIR VERTICAL DISTRIBUTION, AND DESCRIPTIONS OF NEW SPECIES.

By Dr. C. HART MERRIAM.

Sorex monticolus sp. nov. Mountain Shrew.

This new Shrew is common throughout the Boreal zones of San Francisco Mountain. Specimens were secured at various altitudes from the lower edge of the Douglas fir belt (altitude 2,500 meters=8,200 feet) to the upper limit of the Subalpine or timber-line zone (altitude 3,500 meters=11,500 feet), but no traces of it were found in the pines. Its nearest relative seems to be *Sorex vagrans* of the Pacific coast. It may be known from the following description:

SOREX MONTICOLUS sp. nov.

Type No. $\frac{17599}{24535}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From San Francisco Mountain, Arizona, August 28, 1889. Collected by C. Hart Merriam and Vernon Bailey. Altitude 3,500 meters (11,500 feet). (Original number, 406.)

Measurements.—Total length, 107; tail vertebræ, 45; hairs, 2; hind foot, 12.5 (measured in the flesh); ear from crown 3 (measured from the dry skin).

General characters.—This is one of the smaller Shrews. In size, length of tail, external appearance, and coloration it closely resembles *Sorex vagrans* of the Pacific coast. The tail is about as long as the body without the head.

Color.—Upper parts uniform dull sepia brown, becoming paler on the sides; under parts much lighter but without sharp line of demarkation. Tail bicolor, concolor with the body.

Cranial and dental characters.—The skull resembles closely that of *S. vagrans*, from which it differs in having the brain-case broader and more inflated. The front upper incisor has a small but distinct internal basal lobe connivent with its fellow. The first lateral unicuspid is slightly *smaller* than the second. The third is less than half the size of the fourth and nearly as small as the fifth, which latter is minute but distinctly visible from the outside. (See accompanying figure.)

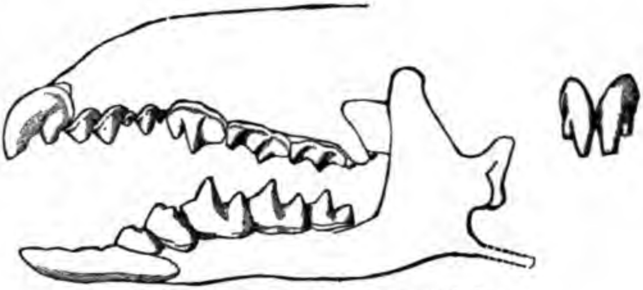

FIG. 1.—Jaws with teeth of *Sorex monticolus*.

Record of specimens collected of Sorex monticolus.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
[illegible]	397	San Francisco Mountain, Arizona.	Aug. 22, 1889	♂ ad.	109	43	13	9,000 feet.
[illegible]	398	......do	....do	♂ ad.	109	44	13	Do.
[illegible]	406	......do	Aug. 28, 1889	♂ ad.	107	45	12.5	11,500 feet. Type
[illegible]	494	......do	Sept. 19, 1889	♂ ad.	107	45	13	8,300 feet.

Vesperugo fuscus Palisot de Beauvois. Large Brown Bat.

This is the commonest Bat of the pine plateau about the base of San Francisco Mountain, where numbers were seen every evening. Six specimens were shot.

Record of specimens collected of Vesperugo fuscus.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Head and body.	Tail.	Head.	Ear from internal basal angle.	Tragus from inner base.	Humerus.	Fore-arm.	Thumb.	Third finger.	Fifth finger.	Tibia.	Hind foot.
18697	235	San Francisco Mountain, Ariz.	July 30, 1889	♂	60	48	21	13	5.5	29	44	8	77	57	19	11
18698	236	...do	....do	♀	65	48	23	13.5	5.5	30	...	8.5	83	60	19	11
18699	237	...do	....do	♂	58	51	21	14	5.5	....	48	9	83	60	...	11.5
18700	256	...do	Aug. 1, 1889	♂	63	48	22	13	5.5	31	48	8	79	58	19	11
18701	257	...do	....do	♂	63	48	21.5	12.5	5	28	44	8	74	58	18	10
18702	258	...do	....do	♂	58	42	21	12.5	5.5	..	..	8	77	...	18.5	10.5

Vesperugo hesperus H. Allen. Pigmy Bat.

This tiny Bat is the smallest species known to inhabit the United States and is one of the most beautiful, its soft whitish fur contrasting handsomely with its black ears, lips, and wings. It was found in large numbers at Grand Falls on the Little Colorado River, and at the Grand Cañon of the Colorado along the Cocanini Plateau, and also about a small spring at the eastern foot of the great lava flow which ends about 5 miles west of Grand Falls on the desert. It spends the day hiding in crevices in the cliffs, emerging at night-fall to drink and hunt its insect prey. Its flight is so swift and zigzag that it is a very difficult species to shoot in the rapidly fading light. The young, as usual among bats, fly more slowly and steadily and are easily killed.

Record of specimens collected of Vesperugo hesperus.

U.S. National Museum No.	Locality.	Date.	Sex.	Head and body.	Tail.	Head.	Ear from internal basal angle.	Tragus from inner base.	Humerus.	Fore-arm.	Thumb.	Third finger.	Fifth finger.	Tibia.	Hind foot.
1685	Little Colorado River, Arizona.	Aug. 19, 1889	♂ ad.	36	29	14	9.5	3	19	30.5	3.5	49	35	10	6.5
1686	... do	...do	♀ ad	36	31	14	9.5	3	18.5	30	4	50	36	.....	6.5
1687	Grand Cañon of the Colorado, Arizona.	Sept. 10, 1889	♂	33	30	13	9	3	17.5	29	4	47	34	10	5.5
1688	....do	....do	♂	33	28	13	....	....	17	27.5	3.5	43	33	10	5.5
1689	....do	....do	♂	36	30	14	9	3.2	18.5	29	3.5	47.5	34	10	5
1690	... do	...do	♀	40	33.5	14	9.5	3	19	30.5	3.5	50	37.5	11.5	5
1691	....do	Sept. 13, 1889	♂	35.5	29	13.5	8.75	3.2	18	....	3.5	47	34	10.5	5
1692	....do	....do	♀	35	30	14	10	3.5	19	....	3.5	51	38	11.5	5.5
1693	....do	...do	♂	35	31.5	14	9	3	17.5	....	4	50	35.5	11.5	5.5

Vespertilio lucifugus LeConte. Common Brown Bat.

Three specimens of a small brown bat, provisionally referred to this species, were secured at Little Spring, at the north foot of San Francisco Mountain.

Record of specimens collected of Vespertilio lucifugus

U.S. National Museum No.	Original No.	Locality.	Date.	Sex.	Head and body.	Tail.	Head.	Ear from internal basal angle.	Tragus from inner base.	Humerus.	Fore-arm.	Thumb.	Third finger.	Fifth finger.	Tibia.	Hind foot.
1694	254	San Francisco Mountain, Aris.	Aug. 1, 1889	♀	48	48	16	12	5.5	26	39	6.5	66	52	18	8
1695	255	....do	....do	♂	45	41	18	12.5	5.5	25	38	8.5	63	50	16	8.5
1696	290	....do	Aug. 7, 1889	♀	49	50	16	12	5.2	25	38	6.5	63	50	18	8.5

Vespertilio evotis H. Allen. Long-eared Bat.

A single specimen of this species was found dead near the water at Little Spring, at the north foot of San Francisco Mountain, on the morning of August 15.

Record of specimen collected of Vespertilio evotis.

U.S. National Museum No.	Original No.	Locality.	Date.	Sex.	Head and body.	Tail.	Head.	Ear from internal basal angle.	Tragus from inner base.	Humerus.	Fore-arm.	Thumb.	Third finger.	Fifth finger.	Tibia.	Hind foot.
18683	363	San Francisco Mountain, Ariz.	Aug. 15, 1889	♂	48	44	18.5	19	9.5	24.5	39	7	63	50	19	9

Vespertilio melanorhinus sp. nov. Black-nosed Bat.

While encamped at Little Spring, at the north base of San Francisco Mountain, I found a small golden-brown bat hanging head down from the inside of a trough made of a large pine log. It hung so low that its sharp, black nose almost touched the water. It proved to be an adult male of an undescribed species belonging to an unnamed section of the genus *Vespertilio*, characterized by having the upper incisors parallel as in *Kerivoula*, instead of divergent as in *Vespertilio* proper. The only other *Vespertilio* known to possess this peculiarity is *V. ciliolabrum*, a species recently described by the writer from Kansas and New Mexico.

VESPERTILIO MELANORHINUS sp. nov.

Type No. 18684, ♂ ad. (in alcohol). U. S. National Museum. (Department of Agriculture collection.) From San Francisco Mountain, Arizona, August 4, 1889. Collected by C. Hart Merriam. (Original number, 275.)

Measurements.—Head and body, 40; tail vertebræ, 43; head, 16; ear from internal basal angle, 13; tragus, from inner base, 6; humerus, 22; fore-arm, 32; thumb, 3.5; third finger, 57; fifth finger, 44; tibia, 14.5; hind foot, 7.

General characters.—Upper incisors parallel, directed inward; inner incisor slightly larger than outer, its crown bifid. First upper premolar small but with well-developed conical cusp, situated on inner side of tooth-row in contact with base of canine; second upper premolar minute, without well-developed cusp, situated on inner side of pm. 1, with which it is in contact; third premolar nearly as large as canine, molariform.

Crown of head but slightly elevated above plane of face; muzzle, narrow; naked area over nostrils small; glandular prominences between eyes and nose small and inconspicuous; sides of upper lip clothed with a dense fringe of long, straight, and rather stiff hairs, as in *V. ciliolabrum*.

e rather small, about equaling *V. nigricans;* tail a little longer head and body, the extreme tip projecting. Ears shorter than , rather narrow, the tips not reaching end of nose when laid for- ; anterior basal lobe angular, the horizontal and vertical borders ing at a right angle; anterior (or inner) border of ear strongly ex on lower two-thirds, becoming straight on upper third; tip ly rounded, with a slight posterior projection resulting from a ow emargination, which occupies the upper half of the posterior uter) border; lower half of posterior border convex, with a thick e near the point of insertion, which is on a line with the anterior er of the tragus; tragus long and slender, directed forward and ard; upper third narrow; anterior border straight in lower two- ls, upper third convex, tip evenly rounded; outer border with a nct rounded lobule at base, above which it is convex on the lower thirds, and then rapidly becomes narrower and is sinuate and tly concave on the upper third. Thumb very short, only about as long as foot, and armed with a sharp and strongly curved nail. of medium size; wing membranes from metatarsus at base of toes; r surface furred only as far as a line drawn from the middle of the erus to the knee; under surface furred to a line joining the knee elbow. Interfemoral membrane furred above to a little beyond lle of tibia; calcaneum reaching about half way from foot to tip of postcalcaneal lobule small but distinct.

lor.—Upper parts uniform dull golden-brown, except the lips and below and in front of the eyes, which parts are abruptly black; r parts paler, palest posteriorly. Ears, face, and membranes black. er fur everywhere blackish.

neral remarks.—*Vespertilio melanorhinus* requires comparison with one species, namely, *V. ciliolabrum,* from which it differs in having ter ears and longer legs and tail, as well as in color and minor ils of form and proportions.

Record of specimen collected of Vespertilio melanorhinus.

Original No.	Locality.	Date.	Sex.	Head and body.	Tail.	Head.	Ear from internal basal angle.	Tragus from inner base.	Humerus.	Fore-arm.	Thumb.	Third finger.	Fifth finger.	Tibia.	Hind foot.	Remarks.
275	San Francisco Mountain, Ariz.	Aug. 4, 1889	♂ ad.	40	43	16	13	6	22	32	3.5	57	44	14.5	7	Type.

inomus brasiliensis Is. Geoff. St. Hilaire. Brasilian Free-tailed Bat.

Free-tailed Bat which is provisionally referred to this species is very dant along the Little Colorado River near Grand Falls, where it bits crevices in the *sandstone cliffs.* It was not observed elsewhere. *specimens were secured.*

Record of specimens collected of Nyctinomus brasiliensis.

U. S. National Museum Number.	Original No.	Locality.	Date.	Sex.	Head and body.	Tail.	Exserted part of tail.	Head.	Ear from base of tragus.	Tragus from inner base.	Humerus.	Forearm.	Thumb.	Third finger.			Fifth finger.	Tibia.
														Metacarpal.	First phalanx.	Second phalanx.		
18715	377	Grand Falls of Little Colorado River, Arizona.	Aug. 14, 1889	♀	58	34	15	21	14	2	....	43	8	41	16	15^5	43	12^5
18716	378	....do..........	....do	♀	59	34	11	21^5	13	2^5	24	44	8	43	16^5	15^5	43	12
18717	379	....do..........	....do	♀	59	36	19	21	13^5	2	25	45	7^5	43^5	17	15^5	44	12^5
18718	380	...do..........	....do	♀	54	..		20^5	13^5	2	24	43	7	40	15	14	37	....
18719	381	....do	....do	♀	53	36	16	20^5	14	2	23^5	42^5	7^5	41	16^5	14	42	12
18720	382	....do..........	....do	♂	54	33	18	20^5	13^5	2^5	24	41	7	40	15	14	39^5	12
18721	383	....do..........	....do	♂	56	31	16	20^5	14	2	22^5	40	7	38	15	14	37	11^5

Sciurus fremonti mogollonensis Mearns. Red Squirrel; Chickaree.

The Red Squirrel of San Francisco Mountain inhabits the Bor
zones and is equally common, according to my observation, from
bottom of the Douglas fir belt to timber line. It is not nearly so no
as its eastern congener, which its note suggests, though differing c
siderably from it. It feeds on seeds from the cones of the spruce a
fir trees, and heaps containing many bushels of the scales of these co
may be found beneath the trees where it lives. Full-grown young w
taken during the latter part of August. It is doubtful if the San Fr
cisco Mountain Chickaree ever descends so low as the Piñon b
though it may do so in winter. At all events it was not seen in
Pine belt, which separates the Douglas fir from the Piñon. The dif
ence in altitude between the lower border of the Douglas fir, wh
this squirrel is common, and the upper border of the Piñon belt, is o
a little more than 300 meters (about 1,000 feet), and the distance
tween the two zones, at the point where they come nearest togethe
only about a mile (on the northeast side of the mountain—in other
rections it is much greater), and yet the faunal boundaries are so shar
defined that this seemingly insignificant difference constitutes a bar
as impassable as an arm of the ocean.

Dr. E. A. Mearns has recently separated subspecifically the
Francisco Mountain Chickaree from the form inhabiting the Ro
Mountains.* The principal difference is that the former is sligl
larger than the latter, with larger ears and hind feet.

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* Bulletin American Museum of Natural History, Vol. II, No. 4, pp. 277–280. S
rates issued February 21, 1890.

Record of specimens collected of Sciurus fremonti mogollonensis.

Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
231	San Francisco Mountain, Arizona.	July 30, 1889	♀ ad..	345	142	54	Nursing; teats $\frac{4}{4}$.
248	....do	July 31, 1889	♂ ad..	320	121	55	End of tail gone.
266	.....do	Aug. 2, 1889	♂ ad..	335	130	52	
270	......do	Aug. 3, 1889	♂ ad..	320	120	55	Do.
271	.....do	....do	♀ ad .	340	140	54	Nursing; teats $\frac{4}{4}$.
272	. ...do	....do	♂ im..	304	127	52	
359	.....do	Aug. 14, 1889	♀ im..	320	137	51	
371	.....do	Aug. 17, 1889	♂ im..	293	129	51	Young; milk in stomach.
391	.....do	Aug. 21, 1889	♂ ad .	365	156	54	
393	.....do	....do	♀ im..	325	141	49	
400	......do	Aug. 22, 1889	♀ ad..	350	148	54	Lately nursing; teats $\frac{4}{4}$.
418	......do	Aug. 28, 1889	♀ ad..	340	143	54	Do.
419	.....do	Aug. 29, 1889	♂ ad..	330	138	51	
552	......do	Sept. 29, 1889	♂ ad..	340	135	53	
553	......do	....do	♀ ad..	333	142	52	Teats $\frac{4}{4}$.
554	......do	....do	♀ ad..	323	134	50	Do.
555	.....do	....do	♀ ad..	335	143	52	
564	.... do	Oct. 5, 1889	♀ ad..	335	137	54	Do.

rus aberti Woodhouse. Abert's Squirrel.

is large and handsome Squirrel is restricted to the pine area and not detected in a single instance either in the Douglas fir belt above, the piñon and cedar belt below. At the same time it undoubtedly invade the upper part of the piñon zone when the piñon nuts are It is common everywhere in the pines, and is particularly fond e large seeds of *Pinus flexilis*, though the smaller ones of *Pinus lerosa* constitute the greater part of its food because of the much ter abundance of the latter tree.

builds large covered nests of green pine branches, lined with soft s, among the limbs of the trees, but also avails itself of holes in trunks when suitable openings can be found. As a rule it is un- and may be easily approached within short gunshot range; but really frightened it runs swiftly over the lava rocks for a long dis- e before taking to a tree, often passing over the roots of many large s in its flight. On reaching the tree of its choice, it climbs to the top, and then, unlike any other squirrel with which I am familiar, ls out to the small end of a branch about which it curls and re- s motionless. When in this position it is exceedingly difficult to though considerably larger than our eastern Gray Squirrel; and even onspicuous white under side of the bushy tail is so coiled about ody as to aid in deceiving the observer.

e long and handsome *ear-tufts* are shed in the spring, and the new ones do not attain their full growth until the early part of winter; hence specimens taken in summer have naked or nearly naked ears. The young begin to appear about the middle of September and are very tame and unsuspicious. Their ear-tufts grow much more rapidly than those of the adults, or at least begin to grow earlier in the season, so that in September and October the young have much longer tufts than their parents.

Whether the species raises two litters in a season I was not able to determine, but females with udders full of milk were shot as late as the middle of September.

Abert's Squirrel was first described by Dr. S. W. Woodhouse from specimens collected by himself at San Francisco Mountain in October, 1851, when attached to the Sitgreaves Expedition.

Record of specimens collected of Sciurus aberti.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	267	San Francisco Mountain, Arizona	Aug. 2, 1889	♀ ad.	515	230	[illegible]
[illegible]	273	do	Aug. 4, 1889	♂ ad.	508	225	[illegible]
[illegible]	274	do	do	♂ ad.	505	224	[illegible]
[illegible]	323	do	Aug. 9, 1889	♀ ad.	510	230	[illegible]
[illegible]	404	do	Aug. 25, 1889	♂ ad.	520	240	[illegible]
[illegible]	405	do	Aug. 29, 1889	♂ ad.	500	230	[illegible]
[illegible]	428	do	Sept. 2, 1889	♂ ad.	495	238	[illegible]
[illegible]	429	do	do	♂ ad.	495	230	[illegible]
[illegible]	430	do	do	♀ ad.	500	235	[illegible]
[illegible]	439	do	Sept. 6, 1889	♂ ad.	445	195	[illegible]
[illegible]	462	do	Sept. 16, 1889	♀ im.	455	210	[illegible]
[illegible]	463	do	do	♂ im.	470	227	[illegible]
[illegible]	499	do	Sept. 19, 1889	♀ ad.	510	238	[illegible]

Tamias cinereicollis J. A. Allen. San Francisco Mountain Chipmunk.

Type No. $\frac{17597}{24533}$ ♀ ad. U. S. National Museum (Department of Agriculture collection). From San Francisco Mountain, Arizona, August 1, 1889. Collected by C. Hart Merriam and Vernon Bailey. Original number, 260.

This new species of Chipmunk, which has just been described by Dr. J. A. Allen from specimens obtained at San Francisco Mountain,* is abundant throughout the pine plateau and the Douglas fir zone, and reaches up the mountain as high as timber line. It is most common where the Douglas fir and pine overlap. Unlike many of its congeners it is a good climber and is often found hidden among the dense foliage of the balsams. It is a lively and rather noisy species, feeding chiefly on seeds of small plants, and hibernating late or not at all.

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* Bull. Am. Mus. Nat. Hist., N. Y., III, No. 1, 94–96. Separates issued July, 1890.

Record of specimens collected of Tamias cinereicollis.

Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
234	San Francisco Mountain, Arizona	July 30, 1889	♂	212	100	35	
246	do	July 31, 1889	♀ ad.	228	106	34	
247	do	do	♀ ad.	228	102	34	
259	do	Aug. 1, 1889	♀ ad.	242	109	36	Lately nursing; teats $\frac{4}{4}$.
260	do	do	♀ ad.	235	104	35	Do.
269	do	Aug. 3, 1889	♀ ad.	222	95	35	Nursing; teats $\frac{4}{4}$.
309	do	Aug. 8, 1889	♂	231	101	36	
346	do	Aug. 12, 1889	♀	225	105	35	
347	do	do	♀	218	96	35	
348	do	do	♂	225	101	34	
352	do	do	♀	213	99	35	
357	do	Aug. 13, 1889	♀	221	100	34	
358	do	Aug. 14, 1889	♂	230	106	35	
365	do	Aug. 16, 1889	♂ ad.	230	105	35	
411	do	Aug. 28, 1889	♀	220	101	35	
412	do	do	♀	225	101	33	
413	do	do	♀	230	105	34	
414	do	Aug. 29, 1889	♂	225	106	35	
415	do	Aug. 26, 1889	♀	223	101	34	
416	do	Aug. 28, 1889	♀	220	101	35	
565	do	Oct. 5, 1889	♂	215	97	33	

ias dorsalis Baird. Gila Chipmunk.

ıe Gila Chipmunk is tolerably common among the cliffs along the k of the Grand Cañon of the Colorado on the Coconino Plateau, but y and difficult to obtain. Chipmunks believed to be this species seen at Walnut Cañon and at Turkey Tanks, but were not red.

Record of specimens collected of Tamias dorsalis.

Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
446	Grand Cañon, Arizona	Sept. 14, 1889	♀ ad.	220	100	33
456	do	do	♂	218	100	34

ias leucurus cinnamomeus subsp. nov. White-tailed Chipmunk.

ıis new subspecies of the Antelope Squirrel or White-tailed Chip-k is tolerably common in suitable places throughout the Desert of Little Colorado and the piñon belt, and is found also in the Grand on of the Colorado. It was observed in greatest abundance near Ave, at the south end of Echo Cliffs, and along the upper part of

Moencopie Wash. It is a rock-loving species, and was seldom seen far from cliffs or lava beds, though in a few instances it was found on the open desert. At Echo Cliffs it was feeding largely on the seeds of *Rhus aromatica trilobata*; in the piñon belt it was feeding on piñon nuts (*Pinus edulis*); and one killed on the desert had its cheek pouches filled with cactus seeds (*Opuntia* sp.?).

This form of Antelope Squirrel may be distinguished from true *Tamias leucurus* by the following description:

TAMIAS LEUCURUS CINNAMOMEUS subsp. nov.

Type No. $\frac{17987}{24898}$ ♀ ad. U. S. National Museum (Department of Agriculture collection). Echo Cliffs, Painted Desert, Arizona, September 22, 1889. Collected by C. Hart Merriam and Vernon Bailey. (Original number 510.)

Measurements.—Total length, 220; tail vertebræ, 76; hind foot, 40 (taken in flesh). Ear from crown 6 (from dry skin).

General characters.—Differs from *Tamias leucurus* in the greater length of the ears, tail, and hind feet, and in the ground color of the upper parts, which are uniform pale cinnamon, inconspicuously lined with black-tipped hairs, and slightly paler on the sides of the shoulders, rump, and legs than on the back. There is no trace of the grizzled-gray color which characterizes *T. leucurus*, particularly in winter pelage. Almost the only difference in color between the summer and winter coat is that the latter is darker and more vinaceous cinnamon. The summer pelage is short and coarse; the winter pelage long and silky. The fall moult takes place in September and October and progresses from behind forwards. Several specimens procured during the latter part of September are in the change, the new coat covering the back and rump while the old remains on the head and shoulders.

Specimens from the cedar belt are slightly darker than those from the desert.

The Antelope Squirrel and its geographic races afford striking illustrations of the exhibition of two principles of color adaptation combined in the same individual. When at rest, the animal is seldom seen, its color and markings being in complete harmony with its surroundings, in obedience to the law of *protective* coloration. But the instant it starts to run, the tail is elevated and its conspicuous white under-side is turned toward the observer, forcing itself upon the eye whether on the lookout for it or not. This is an example of what Professor Todd has termed *directive* coloration, under which head are classed colors and markings which promote mutual recognition at a distance.*

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* J. E. Todd in American Naturalist, XXII, 1888, 201-207.

Record of specimens collected of Tamias leucurus cinnamomeus.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	510	Moa Ave, Painted Desert, Arizona	Sept. 22, 1889	♀	220	76	40
[illegible]	511	......do	....do	♂	223	71	40
[illegible]	517	......do	....do	♀	200	58	38
[illegible]	518	......do	....do	♀	208	69	39
[illegible]	519	......do	....do	♀	220	72	39
[illegible]	525	Moencopie, Painted Desert, Arizona	Sept. 24, 1889	♂	231	70	43
[illegible]	539	Little Colorado River, Arizona	Sept. 26, 1889	♂	210	73	38
[illegible]	540	......do	....do	♀	200	62	39
[illegible]	431	Piñon belt east of O'Leary Peak	Sept. 4, 1889	♂	220	78	39

Tamias lateralis Say. Say's Ground Squirrel.

Say's Ground Squirrel in the San Francisco Mountain country is preeminently characteristic of the pine belt, where it is the most abundant mammal. It extends up into the Douglas fir zone, and stragglers climb even higher on the mountain, a single individual having been found at timber line. It inhabits burrows in the ground, usually in rocky places, and does not climb trees. It has neither the grace nor agility of the arboreal squirrels (*Sciurus*) or the true Chipmunks (*Tamias* proper) but its motions, habits, and voice more nearly resemble those of the Spermophiles (*Spermophilus*) and Prairie Dogs (*Cynomys*).

Its principal food plant in August is *Frasera speciosa*, a rank herb which in general habit resembles our eastern mullein, having a large stalk 4 or 5 feet in height. The Chipmunks were often seen climbing these stalks for the purpose of feeding on the seeds. A little later they turned their attention to the ripening seed-pods of *Pentstemon barbatus torreyi*. Their manner of procedure when feeding on the seeds of this plant is peculiar and interesting. They stand erect on their hind feet, clasp the stem between their fore paws, and bite it off as high up as they can reach. Then they draw the stem past their faces, biting off each pod as it is reached, until their cheek-pouches are enormously distended. One individual which I shot in the act had thirty-nine unbroken seed-pods in its pouches. They feed also upon the seeds of many other plants, and on green herbage.

We had not been in camp a week when Say's Chipmunks began to come to pick up the crumbs that were left after each meal. Familiarity bred boldness, and we soon found them in the cook tent carrying off our meager stock of provisions. These inroads became so serious that we were obliged to kill the culprits, in spite of our admiration of their audacity, beauty, and entertaining manners. They were so numerous that several dozen had to be destroyed before the depredations ceased.

They became very fat during the latter part of August and the first half of September, at which time they began to go into winter quarters. During hot days a few appeared until the time of our departure, the first week in October, but they were silent and did not run about much.

Record of specimens collected of Tamias lateralis.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	232	San Francisco Mountain, Arizona	July 30, 1889	♀ ad	267	101	40
[illegible]	233	do	do	♀ ad	250	97	40
[illegible]	238	do	do	♀ ad	247	65	42
[illegible]	239	do	do	♂ im	240	90	40
[illegible]	252	do	Aug. 1, 1889	♀ ad	280	94	42
[illegible]	253	do	do	♀ ad	280	104	42
[illegible]	261	do	Aug. 2, 1889	♀ im	263	102	43
[illegible]	268	do	do	♂ im	261	97	42
[illegible]	288	do	Aug. 5, 1889	♂ im	267	103	41
[illegible]	298	do	Aug. 7, 1889	♂ im	260	100	43
[illegible]	306	do	Aug. 8, 1889	♂ im	255	93	42
[illegible]	307	do	do	♂ ad	275	97	41
[illegible]	308	do	do	♂ ad	292	102	44
[illegible]	317	do	do	♀ im	260	97	43
[illegible]	319	do	do	♀ im	250	64	43
[illegible]	320	do	do	♂	270	90	43
[illegible]	321	do	do	♀	255	88	43
[illegible]	331	do	Aug. 10, 1889	♂	284	98	42
[illegible]	332	do	do	♀ ad	300	100	43
[illegible]	333	do	do	♂ im	270	96	42
[illegible]	334	do	do	♂ im	242	86	38
[illegible]	335	do	do	♂ im	270	98	43
[illegible]	336	do	do	♀ ad	280	93	42
[illegible]	337	do	do	♀ ad	265	88	37
[illegible]	341	do	Aug. 11, 1889	♂ ad	285	98	41
[illegible]	342	do	do	♀ im	262	92	42
[illegible]	343	do	Aug. 12, 1889	♂	276	86	42
[illegible]	344	do	do	♂ im	272	76	43
[illegible]	345	do	do	♂ im	246	89	41
[illegible]	353	do	Aug. 13, 1889	♀ ad	273	95	41
[illegible]	354	do	do	♂ ad	282	106	43
[illegible]	355	do	do	♂ ad	280	106	42
[illegible]	356	do	do	♂	270	96	40
[illegible]	364	do	Aug. 16, 1889	♀ ad	290	102	35
[illegible]	417	do	Aug. 29, 1889	♀ im	250	100	40
[illegible]	427	do	Aug. 31, 1889	♂ ad	266	95	43
[illegible]	562	do	Oct. 4, 1889	♂	280	96	42
[illegible]	563	do	do	♀	265	93	41

Spermophilus spilosoma pratensis subsp. nov. Park Spermophile.

The Park Spermophile inhabits the grassy openings or parks of the pine belt, where its faint chirp is often mistaken for the note of a bird. It lives in holes among the tufts of bunch-grass and iris, on whose eeds it largely subsists, in common with *Arvicola mogollonensis*, with which it is often associated. It feeds also on green herbage, various mall seeds, and grasshoppers, the latter forming an important part of he contents of the stomachs examined.

The form inhabiting the north park on the main mountain-side is typical of the new subspecies, its general color being dark russet-hazel, and its spots clearly defined. Specimens from the black lava beds along the lower edge of the pine zone are still darker, exhibiting the darkest phase of coloration yet observed in the species, and are here named *Spermophilus s. obsidianus.* The form inhabiting the desert is very pale, and is here separated specifically under the name *Spermophilus cryptospilotus*, no intermediate forms having been discovered in the intervening region. In fact, the transition from the nearly black soil resulting from the decomposition of the trachyte and basalt of the lava beds to the light soil of the desert is so abrupt that there is no suitable place for intergrades to occur. Protective coloration is almost as marked in this group as in the Horned Toads (*Phrynosoma*) of the same region.

The form of Spotted Spermophile inhabiting the parks of the pine plateau region may be known from the following description:

SPERMOPHILUS SPILOSOMA PRATENSIS subsp. nov.

Type No. $\frac{17650}{24565}$ ♀ ad. U. S. National Museum (Department of Agriculture collection). Pine plateau at north foot of San Francisco Mountain, Arizona, August 5, 1889. Collected by C. Hart Merriam and Vernon Bailey. (Original number 285. Teats $\frac{5}{5}$.)

Measurements.—Total length, 197; tail vertebræ, 60; hind foot, 28 (taken in flesh). Ear from crown 2.5 (from dry skin).

Spermophilus spilosoma pratensis is somewhat larger and considerably darker than *S. spilosoma* proper. The upper parts are uniform russet-hazel, marked with numerous whitish spots from the shoulder to the base of the tail. These spots are bordered posteriorly with blackish, but are not clearly defined anteriorly or laterally. They show a tendency to arrange themselves in transverse rows. The under parts, both eyelids, and sides of the neck are soiled white. The proximal half of the tail above is colored like the back, but is mixed with yellowish and black hairs; the distal half of the tail above is black, bordered with yellowish-brown. The under surface of the tail is yellowish, with a partly concealed sub-apical border of black, and a basal band of rufous.

Record of specimens collected of Spermophilus spilosoma pratensis.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	276	San Francisco Mountain, Arizona	Aug. 4, 1889	♀ im	163	52	
[illegible]	277	do	Aug. 5, 1889	♀ yg	149	47	
[illegible]	278	do	do	♀ yg	158	52	
[illegible]	279	do	do	♂ yg	150	49	
[illegible]	281	do	do	♀ yg	171	58	
[illegible]	282	do	do	♀ ad	195	61	
[illegible]	*285	do	do	♀ ad	197	60	
[illegible]	286	do	do	♀ yg	166	55	
[illegible]	287	do	do	♂ yg	......	55	
[illegible]	295	do	Aug. 6, 1889	♂ im	177	58	
[illegible]	296	do	Aug. 7, 1889	♀ im	170	53	
[illegible]	300	do	do	♀ ad	201	61	
[illegible]	301	do	do	♀ im	176	58	
[illegible]	322	do	Aug. 8, 1889	♀ im	180	60	
	330	do	Aug. 10, 1889	♀ yg	175	55	
[illegible]	339	do	do	♀ yg	171	56	
[illegible]	340	do	do	♀ yg	173	58	
[illegible]	384	do	Aug. 20, 1889	♀ yg	170	62	
	516	do	Sept. 23, 1889	♂	195	62	

* Type.

Spermophilus spilosoma obsidianus subsp. nov. Dusky Spotted Spermophile.

The Dusky Spermophile is a dark form of the Spotted Spermophi group. It inhabits the disintegrated lava soil of the cedar belt, and i relation to *S. cryptospilotus* of the Painted Desert is precisely the san as that of *Onychomys fuliginosus* to *Onychomys pallescens*, both bein striking illustrations of the law of color adaptation. Its relation *Spermophilus spilosoma pratensis* of the parks in the pine belt is ve close, and it may be regarded as a dark form of that animal. It highly probable that the specimens here described do not represe the darkest phase of the subspecies, as they were taken in the upp edge of the cedar belt where the soil is not nearly so black as in ma other places.

SPERMOPHILUS SPILOSOMA OBSIDIANUS subsp. nov.

Type No. $\frac{17674}{24610}$ ♂ ad. U. S. National Museum (Department of Ag culture collection). Cedar belt, northeast of San Francisco Mountai October 1, 1889. Collected by Vernon Bailey. (Original number 55

Measurements (taken in flesh by collector).—Total length, 190; t vertebræ, 65; hind foot, 33. External ears represented by a mere thic ened rim above.

Spermophilus spilosoma obsidianus closely resembles *S. s. pratens* but has longer hind feet and tail, and is uniformly darker, the grou color above being dull sepia-brown instead of russet-hazel. The whit dorsal spots are about as distinct as in *pratensis*, and reach further forward on the nape, but their black edgings are lost in the dark ground color.

Record of specimens collected of Spermophilus spilosoma obsidianus.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
[illegible]	326	Cedar belt, northeast of San Francisco Mountain.	Aug. 9, 1889	♂ ad..	210	68	33	
$\frac{17674}{24618}$	557	......do	Oct. 1, 1889	♂ ad..	190	65	33	Type.

Spermophilus cryptospilotus sp. nov. Desert Spermophile.

This new species is one of the few diurnal mammals which inhabit the hot and arid wastes of the Painted Desert, where it lives in burrows in the sand among the scattered bushes of the spiny grease wood (*Atriplex canescens*). I shot the type specimen near Tenebito Wash, about 40 kilometers (25 miles) east of the Little Colorado, August 17, 1889; and trapped several others at the foot of Echo Cliffs, in the northern part of the Desert, September 23.

It is the palest representative of the group of which *Spermophilus spilosoma* may be regarded as the central form, and its bleached, yellowish pelage is in perfect harmony with its desert surroundings. It may be known from the following description:

SPERMOPHILUS CRYPTOSPILOTUS sp. nov.

[Plate IX, figs. 1, 2, and 3: skull.]

Type No. $\frac{17676}{24612}$ ♂ ad. U. S. National Museum (Department of Agriculture collection.) From Tenebito Wash, Painted Desert, Arizona, August 17, 1889. Collected by C. Hart Merriam.

Measurements (taken in flesh by collector).—Total length, 190; tail vertebræ, 60; hind foot, 32. Ear from crown 2 (taken from dry skin).

Spermophilus cryptospilotus is the palest known form of the *S. spilosoma* group. In the type, which is an adult male in worn summer pelage, the ground color above is uniform buffy-clay-color, without spots. When held in certain lights, faint traces of the obsolete spots may be detected. Patches of the fresh fall coat are coming in behind the ears and on the sides of the neck. The tail is colored like the back, but is more yellowish below, and has a partially concealed subterminal black band.

Another adult (No. 17678, from the foot of Echo Cliffs), a recently nursing female (with pectoral teats $\frac{1}{1}$; inguinal $\frac{3}{3}$), is in the same worn breeding pelage though killed as late as September 23. The color above is tinged with vinaceous cinnamon, and there are no traces of spots. Two others taken at the same place the same day (Nos. 17677 and 17679), and probably young of the year, though full grown, are in the new unworn pelage and are distinctly marked with whitish spots on the rump and posterior part of the back, and the rest of the back is mixed with hoary.

Record of specimens collected of Spermophilus cryptospilotus.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
17870/24613	374	Painted Desert, Arizona.	Aug. 17, 1889	♂ ad	190	60	32	Type, from Tenebito Wash.
17872/24618	513	......do	Sept. 23, 1889	♀.....	206	72	31.5	
17877/24615	514	......do	.....do	♀.....	194	66	33	
17878/24614	515	......do	....do	♀ ad..	210	72	32	Teats ⅘.
23171/30469	516	......do	.... do	♂.....	195	62	31	

Spermophilus grammurus Say. Ground Squirrel or Spermophile.

The home of this Spermophile is in the piñon and cedar belt. It rarely occurs so high up as the lower edge of the pines, and still more rarely in the desert below the edge of the cedars. It is particularly abundant along the brink of the Grand Cañon of the Colorado, living in ledges and crevices among the rocks, and feeding chiefly on piñon nuts when they are to be had. Unlike Abert's Squirrel, which it nearly equals in size, it is very wary and difficult of approach. Young about two-thirds grown were found near the mouth of their holes early in September.

Record of specimens collected of Spermophilus grammurus.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	436	San Francisco Mountain, Arizona	Sept. 5, 1889	♀ ad..	440	183	58
[illegible]	437	......do	.....do	♂ ad..	478	208	59
[illegible]	457	Grand Cañon (7,500 feet), Arizona..........	.....do	♂ ad..	460	194	57
[illegible]	458	......do	.....do	♀ ad..	460	198	58
[illegible]	438	San Francisco Mountain, Arizona	.... do	♂ im..	425	190	58
[illegible]	454	Grand Cañon (7,500 feet), Arizona..........	Sept. 14, 1889	♂ im..	405	182	59
[illegible]	455	......do	Sept. 13, 1889	*♂ im.	400	146	60

* Tail short.

Cynomys gunnisoni Baird. Prairie Dog. [Plate IX, figs. 5, 6, and 7: skull.]

Prairie Dogs abound throughout the Sonoran region, occurring in scattered colonies on the Little Colorado Desert and in nearly all the parks in the cedar and pine belts. A few are found as high up as the parks that penetrate the Douglas fir zone. They are abundant in the large meadow in which Fort Moroni is situated, at the west foot of San

Francisco Mountain, and are common within 2 miles from the town of Flagstaff, where I have seen dozens of them feeding in a field of ripening oats which had been ruined by their depredations. Their boldness in permitting me to approach within a stone's throw before diving into their burrows shows that no effort had been made to destroy them. As a rule they are not easily trapped, but under ordinary circumstances ranches of reasonable size may be kept clear of them by the use of bisulphide of carbon.

The San Francisco Mountain Prairie Dog is typical *gunnisoni* of Baird, and differs from the white-tailed animal from Wyoming, the latter being as yet unnamed.*

Record of specimens collected of Cynomys gunnisoni.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	324	San Francisco Mountain, Arizona	Aug. 9, 1889	♀ ad.	330	60	55
[illegible]	464	do	Sept. 16, 1889	♂ ad.	330	59	59
[illegible]	536	do	Oct. 1, 1889	♀ ad.	323	53	53
[illegible]	325	do	Aug. 9, 1889	♂ im.	320	70	58

Castor canadensis Kuhl. Beaver.

Beavers still inhabit the lower part of the Little Colorado, at least at certain times of the year, but what becomes of them when the river dries up I am unable to say. Perhaps they move down into the Grand Cañon of the Colorado, where water is always plentiful. We found Beaver cuttings at Tanner's Crossing. Woodhouse states that he found lodges on the Little Colorado, near the mouth of the Zuñi, in October, 1851; Kennerly says that in December, 1853, Beavers were "very common in many places" along the Little Colorado; and Möllhausen speaks of finding their dams on the same stream.

Onychomys fuliginosus sp. nov. Dusky Scorpion Mouse.

This new species of Scorpion Mouse inhabits the piñon and cedar belt and the lava beds between San Francisco Mountain and the Desert of the Little Colorado, where its dark, almost blackish coloration, unique in the genus, is in as complete accord with the prevailing color of the decomposed lava and 'malpais' soil on which it lives as the pallid-cinnamon tints of its congener of the Painted Desert are with its environment. The two forms, though inhabiting adjoining areas, exhibit the extremes of color variation at present known in the genus; yet it is clear that both sprang from a common ancestor in very recent times, for the region which they inhabit was only recently (geologically speaking) rendered habitable for any member of the group. The high plateau on which the Desert of the Little Colorado is situated, and below the general level of which it has been excavated to the depth of 1,000 meters (about 3,000 feet) by the drainage system of the now evanescent stream whose name it bears, was formerly clad in a forest of spruce and fir, the remnants of which still cling to the mountains and buttes that rise above its level, and was too cold and moist to suit the requirements of this type, whose center of distribution is in the semi-tropical arid lands of the Sonoran fauna. Therefore the differentiation must have taken place subsequent to the invasion of the region by the parent form, the well-known laws of protective coloration operating to clothe the colonies which made their homes respectively on the light sandy desert, and in the black lava beds, with garbs which harmonize best with their distinctive surroundings. Nearly parallel cases occur in the *Spermophilus spilosoma* group, the *Perognathus flavus* group, and the *Thomomys* group inhabiting the same region. Better examples of color adaptation to environment would be hard to find.

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* *It will be described in Fauna* No. 4, under the name **Cynomys leucurus.**

A complete series of intergrades between *Onychomys fuliginosus* and *O. melanophrys pallescens* (the pale form inhabiting the Painted Desert) might be expected were it not for the abrupt transition from the dark lava beds to the light-colored soil of the desert. Two somewhat intermediate specimens (Nos. 17,995 and 17,996) were in fact obtained just below the edge of the lava flow a few miles east of Black Tank. Still others may be discovered, in localities not yet explored, which will connect the Scorpion Mouse of the lava beds with that of the desert. But for the present it must be accorded full specific rank.

The stomachs of the specimens collected contained scorpions and insects.

The species may be known from the following diagnosis:

ONYCHOMYS FULIGINOSUS sp. nov.

Type $\frac{17997}{24908}$ ♀ ad. U. S. National Museum (Department of Agriculture collection.) From Black Tank lava beds, northeast of San Francisco Mountain, September 27, 1889. Collected by C. Hart Merriam and Vernon Bailey. (Original No. 547. This specimen is a very old female with the teeth worn down flat. She contained two large embryos.)

Measurements.—Total length, 160; tail vertebræ, 47; hind foot, 21.5 (taken in flesh). Ear from crown, 12.5; ear from anterior root, 16 (taken from dry skin).

General characters.—Size rather large; tail and hind feet short; ears rather large, with lanuginous tufts at base scantily developed; pelage coarser than in the *melanophrys* group.

Color.—Above, blackish slate, darkest along the middle of the back, faintly tinged with fulvous on the sides; under parts white, the hairs of the belly plumbeous at base. Tail dusky above, except the terminal *fourth which is* whitish like the under side; a ring of dusky surrounds *the base of the* tail. The color of the upper parts is more extended in any of the known forms. It completely covers the sides, com- lown to the belly, from which it is separated by a very sharp line emarkation; it also completely covers the posterior and outer cts of the hind legs to the ankles, where it ends abruptly.

neral remarks.—The general color of *Onychomys fuliginosus* suggests immature pelage of *O. leucogaster*, but comparison of specimens dispels the illusion. The type of the present species is one of the st specimens of the genus that has fallen under my observation.

Record of specimens collected of Onychomys fuliginosus.

Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.	Ear from anterior base.	Remarks.
547	Black Tank, lava beds northeast of San Francisco Mountain, Arizona.	Sept. 27, 1889	♀ ad..	160	47	21.5	12.5	16	Type; contained two large embryos.
432	Cedar belt east of San Francisco Mountain, Arizona.	Sept. 5, 1889	♂ im..	152	45	21	12	16	
560	......do	Oct. 4, 1889	♂ im..	145	45	21.5	12	16	
501	Black Tank, lava beds northeast of San Francisco Mountain, Arizona.	Sept. 21, 1889	♀ ad..	160	53	22.5	12	15.5	
500	......do	.....do	♂ im..	135	42	22	11.5	15.5	

chomys melanophrys pallescens subsp. nov. Desert Scorpion Mouse.

his form of *Onychomys* inhabits the Painted Desert and the high a on which the Moki pueblos stand.

ke its congeners it is carnivorous, feeding principally on insects scorpions. The stomachs of all of the specimens procured contained pions, and many were distended with them to the exclusion of other . One contained the hair and flesh of a mouse. The species was troublesome because of its habit of preying upon the small mam- found in our traps. It may be known by the following diagnosis:

ONYCHOMYS MELANOPHRYS PALLESCENS subsp. nov.

pe No. $\frac{4252}{4963}$ ♂ ad. Merriam Collection. Moki Pueblos, Apache ity, Arizona, May 18, 1888.

asurements of type (from dry skin, apparently somewhat over- ed).—Total length, 168; head and body, 125; tail, 45; hind foot, 22; rom crown, 12; from anterior root, 16.5.

neral characters.—Size large, exceeded only by *O. longipes* of Con- ounty, Texas; *ears, feet, and tail* much as in *O. melanophrys*; fur full, long, and soft; orbital ring absent or inconspicuous; lanuginc tuft at base of ear well developed.

Color.—Above, pale tawny-cinnamon, palest anteriorly, and brigl est on the flanks and rump; not noticeably mixed with black-tipp hairs. Below, pure white to roots of hairs.

General remarks.—*Onychomys melanophrys pallescens* differs from *melanophrys* in its somewhat larger size and decidedly paler coloratic An adult female from the Moki villages agrees in all respects with t type. An adult female (No. 17998) from Echo Cliffs, near the north e of the desert, is somewhat smaller and the colors are slightly deep A young adult male (No. 18002) from a gulch a few miles north Moencopie, has a longer hind foot (measuring 24 millimeters), and t upper parts are clay-colored, faintly washed with tawny, particularly the flanks. Three young from Echo Cliffs have the upper parts cle gray, slightly mixed with black-tipped hairs, and in one of them (N 17999) the fur of the belly is plumbeous at base.

Record of specimens collected of Onychomys melanophrys pallescens.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.	Ear from ante
17993/24909	528	Painted Desert, Arizona	Sept. 25, 1889	♀ ad	150	46	21.5	12	[illegible]
18003/24913	520	do	Sept. 24, 1889	♂ ad	160	49	24	12	[illegible]
17998/24910	530	do	Sept. 25, 1889	♂ im	142	47	23	12	[illegible]
18000/24911	531	do	do	♀ juv	123	38	21	12	[illegible]
18001/24912	532	do	do	♂ juv	123	38	20.5	12	[illegible]

Hesperomys eremicus Baird. Silky Cliff Mouse.

Hesperomys eremicus was described by Baird in 1857 from specime collected at Fort Yuma on the Lower Colorado. It is a rock-lovi species and usually makes its home in cliffs or ledges in the dese Following up the Colorado River it passes through the Grand Cañ and enters the Desert of the Little Colorado. Specimens were secu along the sandstone cliffs that border the latter stream, and also at E Cliffs. In the Grand Cañon it is excessively abundant, outnumberi all the other mammals collectively, and proving a nuisance to trapper by constantly getting into traps set for Pocket Mice and ot more desirable species.

During the two nights spent in the cañon these mice came about blankets in great numbers and I was forced to place my scanty st of provisions in a small tree for protection; but even there it was safe, for the mice are excellent climbers, and I shot one by moonli as it peered down at me from a low branch.

Record of specimens collected of Hesperomys eremicus.

Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Grand Cañon, Arizona	Sept. 15, 1889	♂ ad.	200	109	23
do	Sept. 11, 1889	♂ ad.	166	72	22
do	do	*♀ ad.	195	100	23
do	Sept. 12, 1889	♀ ad.	178	98	22.5
do	do	♀ ad.	190	103	20.5
do	do	♂ ad.	174	91	20
do	do	♂ ad.	185	101	20.5
do	do	♀ ad.	182	100	20.5
do	do	♂ ad.	176	95	
do	do	♀ ad.	185	105	20
do	do	♀ ad.	175	97	20
do	Sept. 14, 1889	♂ ad.	194	106	24
do	Sept. 15, 1889	♂ ad.	172	96	21
do	Sept. 15, 1889	♀ im.	185	103	22
do	Sept. 11, 1889	♂ im.	172	99	22
do	do	♀ im.	172	96	22
do	Sept. 12, 1889	♀ im.	182	100	20
do	do	♀ im.	180	98	21
do	do	♀ im.	190	106	22
do	do	♂ im.	173	98	21
do	Sept. 14, 1889	♀ im.	178	100	21.5
do	do	♀ im.	171	96	21
do	Sept. 15, 1889	♀ im.	167	85	22
do	Sept. 11, 1889	♀ im.	162	91	21
do	do	♂ im.	170	95	21
do	do	♂ im.	167	92	21
do	Sept. 12, 1889	♂ im.	160	93	19
Painted Desert, Arizona	Sept. 22, 1889	♂ ad.	178	98	22
do	Sept. 26, 1889	♂ ad.	196	106	23
do	do	♂ ad.	175	95	21.5
do	do	♂ ad.	181	103	21
do	do	♀ ad.	195	103	22
do	Sept. 22, 1889	♀ juv.	168	82	22
do	Sept. 26, 1889	♀ im.	160	87	21.5

* Teats [illegible].

megalotis sp. nov. Leaf-eared Cliff-Mouse.

e-eared Mouse was found at two places only: the Grand he Colorado and the Desert of the Little Colorado. In the ity it inhabits the ruins of ancient cave dwellings in the va flow about a mile east of Black Tank. Specimens of the losely related form were collected by Mr. Bailey at Moccasin izona, near the boundary line between Arizona and Utah, in 1888.

HESPEROMYS MEGALOTIS sp. nov.

[Skull, plate IV; teeth, plate III, figs 1, 2, 3, and 4.]

Type No. $\frac{17943}{24854}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Black Tank, Desert of the Little Colarado, Arizona, September 21, 1889. Collected by C. Hart Merriam (original number 502).

Measurements.—Total length 200; tail vertabræ 108; pencil 10; hind foot 24 (taken in flesh). Ear from crown 21; ear from anterior notch 25 (taken from dry skin).

General characters.—Size large; ears enormous; tail long and sharply bicolor, with a long pencil.

Color.—Upper parts yellowish-brown, strongly suffused with reddish-brown [other specimens lack this suffusion], sides washed with tawny-salmon; ears, narrow ring round eye, and upper surface of tail dusky. Under parts including feet, white; a salmon suffusion across breast.

General remarks—*Hesperomys megalotis* requires comparison with but one species, namely, *H. truei* from Fort Wingate, N. Mex. Through the kindness of Mr. F. W. True, Curator of Mammals in the National Museum, I have the type of *H. truei* before me. Its ears, hind feet, and tail are shorter than those of *H. megalotis;* its skull is broader and flatter, and the notch between the condyle and angle of the jaw is much deeper. Unfortunately the teeth of *H. truei* are worn down to the gums and show no characters. The hind foot of *H. truei* measures 21^{mm}, while in the smallest of four specimens of *H. megalotis* it measures 23^{mm}. Shufeldt records the length of the tail vertebræ as 82^{mm}. in *H. truei;* the shortest perfect tail in four specimens of *H. megalotis* measured 103^{mm}, a difference of 21^{mm}., or a little more than 20 per cent.

Record of specimens collected of Hesperomys megalotis.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	469	Grand Cañon, Arizona	Sept. 11, 1889	♀ ad.	195	103	[illegible]
$\frac{17943}{24854}$	*502	Black Tank, in Desert northeast of San Francisco Mountain, Arizona.	Sept. 21, 1889	♂ ad.	200	108	[illegible]
[illegible]	541	do	Sept. 27, 1889	♀	210	112	[illegible]
[illegible]	545	do	do	♂	178	†83	[illegible]

*Type. †Tail broken.

Hesperomys leucopus rufinus subsp. nov. White-footed Mouse.

The White-footed Mouse of San Francisco Mountain abounds in the open parks as well as in the forests, and extends up the mountain to or beyond the upper limit of tree growth. As in most other parts of

North America it is a constant annoyance to the trapper, getting into all kinds of traps set for other small animals, particularly Arvicolas, Shrews, and Spotted Spermophiles. As a rule, traps must be kept in one place long enough to catch most of the White-footed Mice of the immediate vicinity before much success can be expected with other species. This is due in part to the abundance of these Mice, and in part to the fact that they take all kinds of bait—bread, cheese, cornmeal, oatmeal, and flesh, particularly birds' heads, a favorite bait for Shrews. They are chiefly nocturnal, but are sometimes caught in the day-time. Seeds of small plants and remains of grasshoppers were found in most of the stomachs examined.

The new form may be known from the following description:

HESPEROMYS LEUCOPUS RUFINUS subsp. nov.

[Teeth, plate III, figs. 5, 6, 7, and 8.]

Type No. $\frac{17646}{24582}$ ♀ ad. U. S. National Museum. From San Francisco Mountain. Arizona (altitude 9,000 feet), August 22, 1889. Collected by C. Hart Merriam and Vernon Bailey (original No. 401; contained 7 embryos; teats, $\frac{3}{3}$.)

Measurements.—Total length, 168; tail vertebræ, 69; pencil, 5; hind foot, 19 (taken in the flesh); ear from crown, 13; ear from anterior notch, 18 (taken from dry skin.)

General characters—Similar to *H. leucopus*, but with somewhat larger and broader ears and much shorter tail. There is a lanuginous tuft at anterior base of ears, of which hardly a trace exists in *H. leucopus*. The hallux ends opposite the base of the second toe, while in *H. leucopus* it passes beyond this point.

Color.—Upper parts, deep tawny brown, darkest along the middle of the back, and brightest along the sides, the body color reaching to the elbows and heels; under parts, including feet, white; tail, sharply bicolor, dusky above, whitish below; ears, dark.

Cranial characters.—The zygomatic arches are much broader anteriorly than in *H. leucopus*, and the incisive foramina extend further backward, reaching the plane of the first molar. The most marked cranial character is the shape of the zygomatic arches; anteriorly they stand out from the skull with a distinct 'elbow' at the bend, and in some specimens are actually broader in front than behind, while in *H. leucopus* they are very much narrower anteriorly than posteriorly.

General remarks.—I have compared the San Francisco Mountain White-footed Mouse with nearly a thousand specimens from various parts of North America, and find that it most closely resembles the form inhabiting the Adirondack region in northern New York. The difference in length of tail, however, is great, and the cranial differences are those above mentioned.

Record of specimens collected of Hesperomys leucopus rufinus.

U.S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
17651/24587	240	San Francisco Mountain, Arizona	July 31, 1889	♂ ad.	157	67	21
17644/24586	241	......do	....do	♂ ad.	160	71	21
17648/24564	249	......do	Aug. 1, 1889	♀ ad.	167	70	20
17643/24570	250	......do	....do	♂ ad.	161	74	19
17641/24577	262	......do	Aug. 2, 1889	♂ ad.	168	75	21
17639/24575	289	......do	Aug. 6, 1889	♀ ad.	155	66	19
18057	290	......do	....do	♀ ad.	163	70	20
17640/24576	291	......do	....do	♂ ad.	150	61	19+
17638/24574	297	......do	Aug. 7, 1889	♂ ad.	170	75	21
17645/24541	310	......do	Aug. 8, 1889	♂ ad.	160	66	21
17649/24565	314	......do	....do	♂ ad.	153	64	20
17653/24588	315	......do	....do	♂ ad.	159	69	20
17652/24589	329	......do	Aug. 10, 1889	♂ ad.	151	56	19
17646/24592	*401	......do	Aug. 22, 1889	♀ ad.	168	69	19
17655/24586	425	......do	Aug. 30, 1889	♀ ad.	168	66	20
17647/24595	426	......do	....do	♂ ad.	152	65	20
17655/24591	242	......do	July 31, 1889	♂ im.	125	58	20
17642/24578	263	......do	Aug. 2, 1889	♂ im.	152	65	20
17637/24573	265	......do	....do	♂ im.	150	68	20
17636/24572	292	......do	Aug. 6, 1889	♂ im.	142	61	20
17715/24651	293	......do	....do	♀ im.	140	58	20
17716/24652	316	......do	Aug. 8, 1889	♂ im.	121	44	19
18055/24593	410	......do	Aug. 27, 1889	♂ im.	112	47	19
17654/24596	420	......do	Aug. 29, 1889	♂ im.	155	66	20

* Type.

Hesperomys leucopus sonoriensis Le Conte. Desert White-footed Mouse.

This subspecies inhabits the Painted Desert. Several immature specimens from the edge of the lava beds near Black Tank, and one from the Grand Cañon of the Colorado, are here provisionally catalogued under this name though too young to show positive characters. These are Nos. 17926, 17932, 17942, 17945, 17946, 17947, 17948.

Record of specimens collected of Hesperomys leucopus sonoriensis.

U.S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
18054	521	Painted Desert, Arizona	Sept. 24, 1889	♂ im.	160	70	20
17931/24842	529	......do	Sept. 25, 1889	♀ ad.	156	67	20
17946/24856	542	......do	....do	♂	160	75	20
17932/24843	543	......do	Sept. 27, 1889	♂	156	68	20
17942/24837	546	......do	....do	♂	152	61	20
17933/24840	526	......do	Sept. 25, 1889	♂	146	61	19.5
17941/24862	527	......do	....do	♀	136	56	18
17938/24835	544	......do	Sept. 27, 1889	♂	136	56	19
17945/24858	548	......do	....do	♂	148	62	20.5
17926/[illegible]	549	......do	....do	♀	144	60	19.5
17927/24877	442	Grand Cañon, Arizona	Sept. 15, 1889	♂	146	[illegible]	19.5

toma mexicana Baird. Round-tailed Wood Rat. [Skull, plate X, figs. 5, 6, 7, and 8.]

his Wood Rat is abundant throughout the pine area, where it makes iests in the crevices of rocky ledges. Bulky nests of sticks were id on the ground in the cedar and piñon zone, and also in the ancient e dwellings of the Indians in the volcanic craters and lava flows be- the mountain and in the desert. Cactus spines in large quantities n an important element in and about these nests, and doubtless re as a protection against Coyotes and Skunks. Whether or not the erent kinds of nests are made by the same species I am unable to . Wood Rats are abundant in the Grand Cañon of the Colorado, ere specimens were captured along the cliff at the top of the cañon l also near the bottom.

Record of specimens collected of Neotoma mexicana.

Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	366	San Francisco, Mountain, Arizona	Aug. 16, 1889	♀ ad.	355	163	37
[illegible]	367	do	do	♀ ad.	347	161	37
[illegible]	372	do	Aug. 17, 1889	♂ ad.	383	176	37
[illegible]	373	do	do	♂ ad.	363	164	36
[illegible]	561	do	Oct. 4, 1889	♂ ad.	345	160	37
[illegible]	361	do	Aug. 15, 1889	♀ im.	265	125	34
[illegible]	440	do	Sept. 16, 1889	* ♂ im.	130	48	215
[illegible]	558	do	Oct. 2, 1889	♀ im.	305	146	36
[illegible]	447	Grand Cañon, Arizona	Sept. 15, 1889	♀ ad.	340	157	36
[illegible]	449	do	do	♀ ad.	340	162	36
[illegible]	450	do	do	♀ ad.	330	154	35
[illegible]	453	do	Sept. 14, 1889	♀ ad.	325	152	36
[illegible]	448	do	Sept. 15, 1889	♀ im.	320	150	34

* Very young.

icola alticolus sp. nov. Mountain Vole.

his new species occupies higher altitudes and moister situations n *A. mogollonensis*, the only other Vole known to inhabit the region. s common along the borders of the higher parks, and in the moist dows at and just above timber line on San Francisco Mountain, and ges down to the lower part of the Douglas fir zone, where several cimens were caught at the point where Little Spring comes out of ground. Thus its vertical range is from 2,500 to 3,500 meters 00 to 11,500 feet). Its runways were noticed in great abundance in oist park on the summit of Kendrick Peak. At timber line, on San ncisco Mountain, it feeds extensively on seeds of *Primula parryi*. he species may be known from the following description:

ARVICOLA (MYNOMES) ALTICOLUS sp. nov.

[Skull, plate V, figs. 1 and 2; teeth, plate VI, figs. 1, 2, 3, and 4.]

ype No. $\frac{17815}{24851}$ ♀ *ad.* *U. S. National* Museum (Department of Agri- *re collection). From Little* Spring (altitude 2,500 meters = 8,200 *sco Mountain*, Arizona, July 31, 1889. Contained 6 embryos; teats $\frac{4}{4}$. Collected by C. Hart Merriam and Vernon Bailey. (Original number 243.)

Measurements.—Total length, 170; tail vertebræ, 56; hairs, 8; hind foot, 20 (taken in flesh). Ear from crown, 8; from anterior root, 14 (taken from dry skin).

General characters.—Size medium or rather large; ears large, projecting nearly 4 millimeters above the fur; antitragus small, hardly half as large as in *A. longicaudus;* hind feet of medium length; tail long but shorter than in *A. longicaudus.*

Color.—Upper parts dark bister, suffused with pale reddish-brown, and conspicuously lined with black; under parts hoary plumbeous, the line of demarkation distinct but not sharp. Tail bicolor; dark brown above, darkest near the tip; grayish brown below.

Cranial characters.—Skull large and rather narrow across the zygomatic arches; rostral portion long; incisive foramina about twice as long as premaxillary symphysis; nasals ending posteriorly nearly on a line with the ends of premaxillaries and terminating in a rounded or pointed extremity [this character does not hold in the young]; nasals not strongly decurved; jugals not expanding into a vertical plate or lamella; zygomatic arches spreading posteriorly; outer border of parietals convergent anteriorly.

Dental characters.—The dental characters of this species are those of the western division of the section or subgenus *Mynomes* of Rafinesque—the western species, as a rule, lacking the postero-internal loop or triangle of the middle upper molar, which is a conspicuous character in the eastern *A. riparius.*

General remarks.—*Arvicola alticolus* is nearly related to *A. longicaudus* from the Black Hills of Dakota. It differs from *A. mogollonensis*, the only other species known to inhabit the mountains of northern Arizona, in many particulars, which for convenience of reference have been arranged antithetically in tabular form as follows:

Distinctive diagnoses of Arvicola alticolus and A. mogollonensis.

	A. mogollonensis.	*A. alticolus.*
Total length	Less than 140^{mm}	More than 170^{mm}.
Tail vertebræ	Less than 32^{mm}*	More than 50^{mm}.
Hind foot	18^{mm}	20^{mm}.
Ratio of zygomatic breadth to basilar length of skull.	About 68	About 62.
Incisive foramina	But little longer than premaxillary symphysis.	About twice as long as pr maxilliary symphysis.
Jugal bone	Expanding into a vertical plate or lamella.	Not expanding into a verti plate or lamella.
Zygomatic arches	Widest anteriorly	Widest posteriorly.
Nasals ending posteriorly	Far short of premaxillaries	Nearly on a line with p maxillaries.
Posterior ends of nasals	Emarginate	Rounded or pointed.
Nasals	Strongly deflexed	Not strongly deflexed.
Outer borders of parietals	Parallel anteriorly	Convergent anteriorly.

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[*] *Thirty-two* millimeters is the maximum measurement of tail in fifteen specimens of *A. mogollonensis.*

Record of specimens collected of Arvicola alticolus.

Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
243	San Francisco Mountain, Arizona.	July 31, 1889	♀	170	56	20	Type. Contained six embryos.
251	......do	Aug. 1, 1889	♀	170	55	20	Adult.
409	......do	Aug. 29, 1889	♀	193	53	20	Contained five embryos.
422	......do	Aug. 30, 1889	♂	182	55	20	Adult.
495	......do	Sept. 19, 1889	♂	175	62	20	Do.
403	......do	Aug. 23, 1889	♀	148	47	20	Immature.
407	......do	Aug. 29, 1889	♂	123	36	19	Do.
408	......do	Aug. 28, 1889	♂	157	52	21	Do.
423	......do	Aug. 30, 1889	♀	123	39	19	Do.
424	......do	....do	♀	120	38	19	Do.
496	......do	Sept. 19, 1889	♂	122	41	19	Do.
497	......do	....do	♂	121	37	19	Do.
498	......do	...do	♂	123	39	19	Do.

cola mogollonensis Mearns. Mogollon Vole.

his species, which has been recently named by Dr. Mearns* from immature specimen collected at Baker Butte, on the Mogollon a in central Arizona, inhabits the parks in the pine belt of San ncisco Mountain, but was not found at a greater altitude than 2,500 ers (8,200 feet). It lives in small colonies, with well-beaten paths nways between the various burrows, and feeds principally on the ls of *Artemisia wrightii* and related species, and also upon those of blue iris (*Iris missouriensis*), and the stems of various grasses.

r. Mearns named the species from a young individual with a broken l, but did not point out any characters by which it can be distinhed from other members of the genus. Through the courtesy of J. A. Allen, Curator of Mammals in the American Museum of Natural tory, New York, I have had the opportunity of examining the type comparing it with my series of the same species from San Frano Mountain.† In order that the species may be recognized by future lents of the group, I have prepared the following description, based ifteen specimens collected at San Francisco Mountain, Arizona:

Arvicola mogollonensis Mearns.

[Skull, plate V, figs. 3 and 4; teeth, plate VI, figs. 5, 6, 7, and 8.]

This species belongs to the western division of the subgenus *Myies.*)

leasurements.—Total length, 125 to 140; tail vertebræ, 24 to 32; hairs, hind foot, 18 (taken in flesh). Ear from crown, 5.5; from anterior e, 11 (taken from dry skin).

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*ull. Am. Mus. Nat. Hist. New York, II, 4, 283. Author's separates published Feby 21, 1890.

n Francisco Mountain is about 96 kilometers (60 miles) north of Baker Butte.

General characters.—Size small; tail and hind feet very short; hin feet broad and hairy; ears moderate, not concealed by fur; antitragu of medium or rather large size; pelage long and soft, not "short an hispid" as stated by Dr. Mearns.

Color.—Upper parts uniform light bister, strongly and uniforml suffused with pale reddish-brown, with no tendency to become dark along the middle of the back, and not conspicuously mixed with blac tipped hairs; under parts uniform dark plumbeous overlaid with hoar due to the whitish tips of the hairs. Tail indistinctly bicolor: abov concolor with the back; below somewhat lighter.

Cranial characters.—Skull short and broad; zygomatic arches wide anteriorly or with sides parallel; rostrum short; incisive foramina n more than one-half longer than premaxillary symphysis; nasals abrupt deflexed, emarginate posteriorly, and falling far short of premaxillarie jugals expanding anteriorly into a vertical plate or lamella the low part of which embraces the end of the zygomatic process of the maxi lary; outer borders of parietals parallel anteriorly.

Dental characters.—The dental characters of *Arvicola mogollonensis* a those of the subgenus *Mynomes.* The postero-internal loop of the mi dle upper molar is generally wanting, as usual in western *Arvicolæ*, b in one specimen it is present (No. 24563). The last upper molar co monly has three re-entrant angles on its inner face, but sometimes h four owing to an extra fold on the posterior crescent. The front low molar usually has two and sometimes three closed triangles on the inn side. The range of variation is well shown in the accompanying figur (see pl. VI, figs. 5–8).

An antithetical diagnosis of *A. mogollonensis* as compared with *A alticolus* has been given under the head of the latter species.

Record of specimens collected of Arvicola mogollonensis.

U.S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
[illegible]	283	San Francisco Mountain, Arizona.	Aug. 5, 1889	♀	139	32	18	Contained three bryos.
[illegible]	284	......do	....do	♀	127	28	17	Nearly full grown.
[illegible]	294	......do	Aug. 6, 1889	♂	130	27	18	Old.
[illegible]	302	......do	Aug. 7, 1889	♂	130	30	18	Do.
[illegible]	303	......do	....do	♀	136	29	18	Contained three bryos.
[illegible]	304	......do	....do	♂	126	28	17	
[illegible]	305	......do	.... do	♂	133	30	18	Adult.
[illegible]	311	......do	Aug. 8, 1889	♂	127	24	18	Do.
[illegible]	312	......do	....do	♂	128	26	16	
[illegible]	313	......do	...do	♀	128	27	16	
[illegible]	327	......do	Aug. 10, 1889	♀	120	26	18	
[illegible]	328	......do	....do	♀	135	28	18	
[illegible]	392	......do	Aug. 21, 1889	♂	123	26	18	Do.
[illegible]	399	......do	Aug. 22, 1889	♂	128	26	18	
[illegible]	338	......do	Aug. 10, 1889	♂	135	31	18	Do.

fulvus Woodhouse. Woodhouse's Pocket Gopher.

ecies was first described by Woodhouse from specimens pro. San Francisco Mountain in October, 1851. It is very abunighout the pine belt, and occurs also in suitable places all the e side of the mountain to timber line.

Record of specimens collected of Thomomys fulvus.

Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
San Francisco Mountain, Arizona	July 31, 1889	♂ ad.	222	70	30
do	Aug. 12, 1889	♂ ad.	203	64	28
do	do	♀ ad.	210	73	29
do	Aug. 13, 1889	♂ ad.	215	71	30
do	Aug. 15, 1889	♂ ad.	231	74	30
do	Aug. 21, 1889	♀ ad.	220	75	34
do	do	♂ ad.	210	70	30
do	do	♀ ad.	210	65	30
do	Aug. 22, 1889	♀ ad.	205	60	28
do	Aug. 23, 1889	♂ ad.	217	64	30
do	Aug. 29, 1889	♂ ad.	187	62	27
do	July 31, 1889	♀ im.	216	65	29
do	Aug. 8, 1889	im.	178	59	29
do	Aug. 21, 1889	♀ im.	194	65	28
do	do	♀ im.	178	57	27
do	do	♀ im.	190	56	26
do	Aug. 22, 1889	♀ im.	205	67	30
do	do	♀ im.	193	64	28
Grand Cañon, Arizona	Sept. 14, 1889	♂ im.	170	52	25

perpallidus Merriam. Desert Pocket Gopher.

llid form of Pocket Gopher occurs in isolated colonies in the esert. Specimens collected in the sand flats bordering the orado are almost as pale as the type, which came from the Desert in southern California, except that the tips of the he back, occiput, and sides of the face are strongly marked y clay-color.

Record of specimen collected of Thomomys perpallidus.

Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Painted Desert, Arizona	Sept. 22, 1889	♂	232	79	33

longipes gen. et sp. nov. Moki Kangaroo Rat.

w Kangaroo Rat is common throughout the Desert of the Litdo, but was not found elsewhere. Like its relatives, it lives in burrows in the sand, which are usually closed in the day-time. Mr. Bailey long ago made the discovery that the holes of most species of this group may be recognized at a glance from the fact that they are never dug straight down on a level plain, but are made in a side hill or sand bank so that the entrance is nearly horizontal, and as a rule there is a little mound of sand at the mouth of the burrow, which the animal throws out for the purpose of closing the hole for the day.

The American Kangaroo Rats fall naturally into two groups of generic value, one possessing four toes on the hind foot, the other five. The type of the genus *Dipodomys* (*D. phillipsi*, from Real del Monte, Mexico, described by Gray in 1841) has four hind toes; hence the generic name *Dipodomys* must be restricted to the four-toed species. The first five-toed species described is *D. agilis* (from Los Angeles, California, named by Gambel in 1848), which therefore becomes the type of the new genus, *Dipodops*. The genus *Dipodops* is based on the possession of five complete toes on the hind foot (each toe consisting of metatarsal, phalanges, and claw), without regard to any other character whatsoever. Discussion of the cranial characters of the species of both genera may be found in a special paper soon to be published by the writer.

The species inhabiting the Desert of the Little Colorado may be known from the following description:

DIPODOPS LONGIPES sp. nov.

Type No. $\frac{17703}{24639}$ ♂ yg. ad. U. S. National Museum (Department of Agriculture collection). Foot of Echo Cliffs, Painted Desert, Arizona, September 22, 1889. Collected by C. Hart Merriam. (Original number, 512.)

Measurements.—Total length, 275; tail vertebræ, 165; pencil, 25; hind foot, 42 (taken in flesh). Ear from crown, 8 (taken from dry skin).

General characters.—Similar to *Dipodops agilis*, but with longer hind feet, shorter tail, and much paler coloration.

Color.—Above, uniform ochraceous-buff, finely lined with black-tipped hairs, the latter being most noticeable on the rump; a large pure white spot over each eye and another behind each ear. Cheeks between whiskers and ears, mostly white, slightly mixed with ochraceous. Under parts pure white to base of hairs, including fore legs and feet, band across thighs, and hind feet (except soles, which are dusky). Upper tail stripe dusky, continuous to end of tail, but paler on the crested penicillate portion, where it involves the terminal half of each hair only; under tail stripe very narrow posteriorly and indistinctly continuous with the dark tip of the pencil; lateral white stripes broad and distinct from basal white ring to white basal portion of pencil.

Cranial characters.—The skull of *Dipodops longipes* differs from that of *D. agilis* in the following particulars: The vault of the cranium is

highly arched; the parietals (viewed from above) do not send off
ıg and slender postero-lateral process; the zygomatic bridge of the
illary is evenly rounded off below, instead of sending off a postero-
rnal lobule; the distance across the posterior border of the frontals
ıls that from the front of the nasals to the posterior end of the nasal
ıches of the premaxillaries, and also that from the anterior point of
frontal to the mastoid inflation; and the pit in the horizontal ramus
ıe mandible, behind the last molar, is very much larger than in *D.*
s.

should be mentioned that the present species needs no comparison
D. chapmani, recently described by Dr. Mearns from Fort Verde.

Record of specimens collected of Dipodops longipes.

Original No.	Locality.	Date.	Sex.	Total length.	Tail vert.	Hind foot.
505	Painted Desert, Arizona	Sept. 22, 1889	♂	255	137	43
*512	....do	Sept. 23, 1889	♂	275	105	42
	....do	Sept. 24, 1889	♂	255	150	41

* Type.

gnathus apache Merriam. Apache Pocket Mouse.

ıis Pocket Mouse is probably common in suitable localities through-
the Little Colorado Desert. The type specimen of the species came
ı the high mesa on the east side of the Painted Desert. I caught
mmature individual near Moa Ave at the foot of Echo Cliffs, Sep-
ɔer 25. Its hole was under a greasewood bush on a sand plain.

Record of specimen collected of Perognathus apache.

Original No.	Locality.	Date.	Sex.	Tail length.	Tail vertebræ.	Hind foot.	Remarks.
524	Painted Desert, Arizona.	Sept. 25, 1889	♂ im.	139	72	18.5	Foot of Echo Cliffs.

gnathus flavus subsp. Baird's Pocket Mouse.

n undescribed form of *Perognathus flavus* inhabits the Desert of
Little Colorado. An immature specimen was caught in Tanner's
:h, a few miles north of Moencopie, September 24, but it is too
ıg to admit of satisfactory description.

Record of specimen collected of Perognathus flavus subsp.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
$\frac{17708}{24649}$	522	Painted Desert, Arizona.	Sept. 24, 1889	♂ im..	125	60	19	Near Moencopie.

Perognathus fuliginosus sp. nov. Dusky Pocket Mouse.

The Dusky Pocket Mouse is a dark form of *Perognathus flavus*, inhabiting the lava beds. It is modified in the same manner and for the same reason as *Onychomys fuliginosus*, and the remarks under the head of the latter species apply equally well to the present. An immature specimen was captured in the cedar and piñon zone on the black lava or 'malpais' northeast of the mountain, October 4. It may be known from the following diagnosis:

PEROGNATHUS FULIGINOSUS sp. nov.

Type $\frac{17708}{24644}$ ♂ im. U. S. National Museum (Department of Agriculture collection). From Cedar belt, northeast of San Francisco Mountain, altitude 7,000 feet, October 4, 1889. Collected by Vernon Bailey. Original number, 559.

Measurements.—Total length, 116; tail vertebræ, 58; hind foot, 18 (taken in flesh by collector); ear from crown, 4 (taken from the dry skin).

Characters.—Similar to *Perognathus flavus*, but with the upper parts uniform sooty brown, faintly tinged with yellowish-brown; post-auricular spots and backs of ears yellowish; a fulvous lateral stripe, ill-defined below, merges into the color of the belly, which is strongly suffused with fulvous. In coloration this species is unique in the genus.

Perognathus (Chætodipus) penicillatus Woodhouse. Woodhouse's Pocket Mouse.

San Francisco Mountain is the type locality of this species, but I did not succeed in finding it. Woodhouse, who discovered it when attached to the Sitgreaves Expedition, captured his specimen in October, 1851, at San Francisco Mountain, but does not state the exact spot. His journal, however, shows that it was not far from their camp No. 17, which seems to have been at Hart Spring at the west base of the mountain.

Perognathus (Chætodipus) intermedius Merriam. Intermediate Pocket Mouse.

[Skull, plate V, figs. 5, 6, and 7.]

Five specimens of this species were collected by Vernon Bailey and myself in the Grand Cañon of the Colorado directly below the tank known as 'Cañon Spring,' on the Cocanini Plateau, north of San Francisco Mountain. They were found living in small colonies among rocks and cactus in the Agave zone, which is below the level of the Painted Desert. Like other members of the genus they are strictly nocturnal and feed chiefly on seeds. Two additional specimens were caught in the cliffs of red sandstone at Tanner's Crossing on the Little Colorado River in September.

The specimens here mentioned differ from the type (which came from Mud Spring in northwestern Arizona) in having the rump spines more numerous and of larger size. They vary considerably in lengths of tail and hind feet, as shown by the following table of measurements. One individual in particular (No. $\frac{17976}{24887}$ ♀ from the Grand Cañon) departs more than usual from the type and resembles in some respects *P. spinatus*. Thus the interparietal might almost be described as broadly pentagonal, and the posterior border of the parietals is about as long as the anterior. The front lower molar, however, is that of *intermedius*, and the evident immaturity of the specimen may account for its peculiarities.

Record of specimens collected of Perognathus (Chætodipus) intermedius.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertabræ	Hind foot.
[illegible]	465	Grand Cañon, Arizona	Sept. 12, 1889	♂ ad.	183	101	23
[illegible]	466	......do	....do	♀ ad.	175	105	23
[illegible]	467	......do	....do	♀	175	100	22
[illegible]	468	......do	....do	♂	186	105	23
[illegible]	506	Painted Desert, Arizona	Sept. 22, 1889	♀	172	100	23
[illegible]	538	......do	Sept. 26, 1889	♀	166	93	21

Erethizon epixanthus Brandt. Yellow-Haired Porcupine.

Porcupines inhabit the spruce belt and the sub-alpine or timber-line zone of San Francisco Mountain. No specimens were secured, but numerous gnawings were observed. Their favorite food-tree is the fox-tail pine (*Pinus aristata*). Hundreds of stunted trees of this species growing near timber line show ugly scars where the bark has been eaten. The gnawings which I examined are on the west side of the mountain. Most of them are on the east side (the up-hill side) of the trees, and their height above the ground varies from one to three or four meters. Their average size is hardly greater than a man's hand, though some of them are much larger.

During the fall and winter the Porcupines sometimes descend from the mountain to lower levels, and on several occasions they have been found along the Little Colorado. Sitgreaves and Kennerly mention instances of this kind, and a cattleman told me of a similar case that fell under his observation. Kennerly states that in December, 1853, Porcupines were common along the Little Colorado, where "they find a bountiful subsistence in the bark and tender twigs and buds of the young cottonwood trees;" and Möllhausen, who was with Kennerly, says in his 'Diary,' "from time to time we saw porcupines, *Cercolabes nova*, lazily climbing the trees."

Lepus texianus Waterhouse. Jack Rabbit. [Skull, plate VII.]

Jack Rabbits are common throughout the upper levels of the Little Colorado Desert and in the piñon and cedar belt, and sometimes enter the parks of the pine belt. During the intense heat of the day we frequently started them from their hiding places under the low branches of junipers or in tufts of greasewood. At such times they remain absolutely motionless, squatting close to the ground with their long ears laid flat upon their backs. When in this position their colors harmonize so well with their surroundings that they are rarely seen until they start with a great bound and gallop swiftly away.

Record of specimens collected of Lepus texianus.

U.S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
[illegible]	435	San Francisco Mountain, Arizona.	Sept. 5, 1889	♀ ad..	610	95	142	Killed in cedar belt; nursing.
[illegible]	503	Painted Desert, Arizona.	Sept. 21, 1889	♀ ad..	630	100	147	
[illegible]	550	San Francisco Mountain, Arizona.	Sept. 27, 1889	♀ ad..	610	92	140	Killed in cedar belt.

Lepus arizonæ J. A. Allen. Arizona Cotton-tail; Jack Cotton-tail.
[Skull, plate VIII.]

When overtaken by night in the lava beds of the cedar belt east of O'Leary peak, and many miles from water, I first made the acquaintance of the Jack Cotton-tail, a species which differs strikingly from the other American 'Cotton-tails,' in the great length of its ears. Just at dusk a family of them came out of their hiding-places in the chaparral to feed upon the scattered tufts of bunch-grass which exist even on this porous, arid soil. We found them again, and at the same hour, in the broad strip of piñon and cedars which separates the tall pine forest of the San Francisco Mountain Plateau from that of the Cocanini Plateau bordering the Grand Cañon of the Colorado. Afterward they were found to be tolerably common throughout the piñon and cedar zone, and were sometimes encountered in the Desert, where I shot one in the daytime in one of the small red sand-stone cañons of the Little Colorado River near the point known as Tanner's Crossing.

The great length of the external ears in this species (fig. 2) is correlated with a corresponding increase in the size of the bony parts which incase the organs of hearing, the audital bullæ being fully double the size of those of *Lepus sylvaticus* (see pl. VIII, figs. 1 and 3). The tail also is much longer than in the other members of the *sylvaticus* group.

flesh of the Arizona Cotton-tail is white and tender, but rather

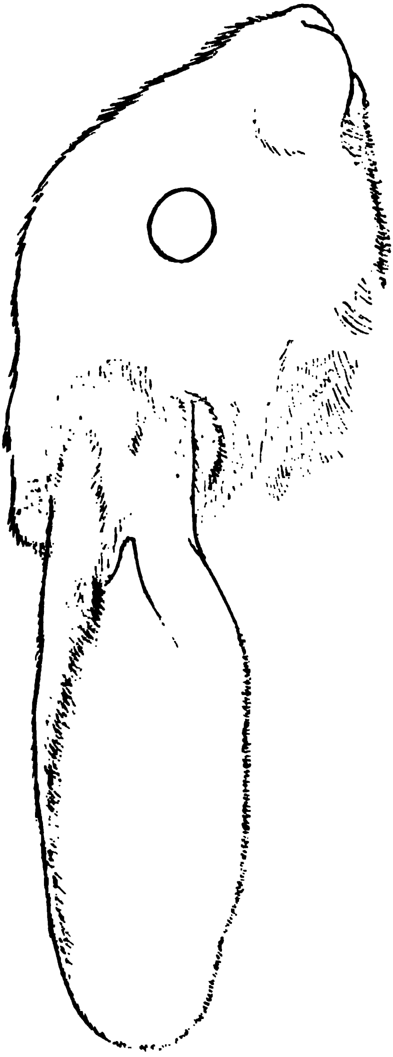

Fig 2.—Head of *Lepus arizonæ*, natural size.

possible that this species may prove to be the same as *Lepus* *ni*, described by Waterhouse in 1838, from a specimen collected iglas during his overland journey from Texas to California, in case, of course, Waterhouse's name will have precedence.

Record of specimens collected of Lepus arizonæ.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	433	San Francisco Mountain, Arizona	Sept. 4, 1889	♀ ad*	393	57	97
[illegible]	434	......do	....do	♂ im	368	28	90
[illegible]	460	......do	Sept. 15, 1889	♂ im	360	45	91
[illegible]	459	......do	Sept. 16, 1889	♂ im	325	48	84
[illegible]	461	......do	Sept. 15, 1889	♀ im	330	46	85

* Ear 85^{mm}.

Cariacus macrotis Say. Black-tailed Deer.

The Black-tailed Deer is abundant on San Francisco Mountain and neighboring peaks and buttes, where it inhabits the boreal zones, coming down into the pines in fall and winter. A fawn in the spotted coat was captured August 5.

Record of specimen collected of Cariacus macrotis.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
[illegible]	280	San Francisco Mountain, Arizona.	Aug. 5, 1889	♂ juv.	730	94	280	Fawn in spotted coat.

Antilocapra americana Ord. Antelope.

The Antelope is still common in the San Francisco Mountain region, where it ranges from the upper levels of the Little Colorado Desert to the upper part of the pine zone. Its center of abundance seems to be in the piñon belt. It does not inhabit the Painted Desert proper, nor the Douglas fir zone. Small herds, composed of two or three to a dozen individuals, were seen frequently in the parks throughout the pine belt, and occasionally in the pine forests away from any openings. They were seen near Partridge Spring and within a mile of Little Spring. A few years ago Antelopes were very abundant throughout this region, but they have been killed off by both Indians and white men. The Indians hunt them on horseback among the lava beds just below the piñon belt, east and northeast of O'Leary Peak.

Ovis canadensis Shaw. Mountain Sheep.

A small herd of Mountain Sheep inhabits the main peak of San Francisco Mountain, where I saw eight or nine individuals together on one occasion (August 23). They are said to leave San Francisco Mountain *in early winter*, and to cross over to Kendrick Peak where they remain until spring, the reason being that there is better feed and protection on Kendrick than on San Francisco Mountain. The two peaks are only 12 miles apart. Sheep are common at the Grand Cañon, where I surprised a small herd September 14.

Felis concolor Linnæus. Mountain Lion; Panther; Cougar.

The Mountain Lion occurs throughout the San Francisco Mountain region, but is not abundant. It is found chiefly in the piñon and pine areas, though it descends at times into the desert. During our stay at the Grand Cañon of the Colorado, about the middle of September, a Mountain Lion carried off a Deer shot by a sheep-herder and left out over night. It is much dreaded by the herders, who lose many sheep and lambs from its depredations.

Two Navajo Indians whom we met at Red Horse Tank, September 10, had quivers made of skins of the Mountain Lion with the tails left on. The tails were much shorter and the color of the pelage darker than in the eastern animal.

Lynx baileyi sp. nov. Plateau Wild-Cat.

Wild Cats are common throughout the region, but whether or not more than one species is represented is an open question. Their tracks were often seen at Little Spring, where they came to drink at night. The only specimen secured was an old female which I shot September 28, in the spruce belt near the upper border of the park that extends far up the mountain above Hart Spring. Although killed as early as 4 o'clock in the afternoon on a clear day, its stomach was distended with small mammals, proving that it sometimes hunts in broad daylight. It contained one Red Squirrel or Chickaree (*Sciurus fremonti mogollonensis*), one Mountain Chipmunk (*Tamias cinereicollis*), two Pocket Gophers (*Thomomys fulvus*), and one Mountain Vole (*Arvicola alticolus*).

The Wild Cat of San Francisco Mountain belongs to an undescribed species, of which I have specimens from various parts of the great Colorado Plateau in Colorado, Utah, and Arizona. It may be known from the following description:

LYNX BAILEYI* sp. nov.

[Skull, plate XI.]

Type No. $\frac{5214}{5909}$ ♀ ad. Merriam Collection. Moccasin Spring, Arizona, December 28, 1888. Collected by Vernon Bailey. (Original number, 66.)

Measurements.—Total length, 745; tail vertebræ, 132; hind foot, 165 measured in flesh by collector). Ear from crown, 60 (from dry skin).

General characters.—*Lynx baileyi* differs from *Lynx rufus* of the eastern United States in being uniformly paler above and in having a shorter tail and softer fur. The upper parts are everywhere suffused with a buffy tint, and the dark markings are decreased in area or altogether suppressed. Thus, the blackish marblings of the face and forehead are obsolete, and the black half ring at the tip of the tail is not more than half the width of that of *L. rufus*. On the other hand, the anterior border of the ear is distinctly whitish, in marked contrast to the black immediately behind it, while in *L. rufus* the same border is dark tawny-brown. The white hind toes of *L. rufus* are absent.

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* Named in honor of my assistant, Mr. Vernon Bailey, who has collected more new species of North American mammals than any other person.

Cranial characters.—The vault of the cranium is greatly inflated compared with that of *L. rufus*, and the constriction behind the supraorbital processes is much less pronounced. The distance from the foramen magnum to the post-palatal notch equals that from the front of the nasals (in median line) to the plane of the supraorbital processes, while in *L. rufus* the former measurement greatly exceeds the latter. The tympanic portion of the audital bulla is inflated and projects anteriorly slightly beyond the inflated capsular portion, making the bulla as a whole wider anteriorly than posteriorly. The reverse is true of *L. rufus*. In *Lynx baileyi* a distinct sulcus marks the line of attachment of the septum which separates the tympanic chamber from the inner chamber. This sulcus is not evident in *L. rufus* except in the young.

I am indebted to Mr. John H. Sage, of Portland, Connecticut, for the loan of two Connecticut specimens of *Lynx rufus*. One of these is a very old male of great size killed at Chester, Connecticut, December 1, 1887. It measured 959^{mm} and weighed 14½ kilograms (32¼ pounds). The other is a half-grown female kitten, killed at the same locality December 19, 1887. It measured 658^{mm} and weighed 4 kilograms (8 pounds 10 ounces).

Record of specimen collected of Lynx baileyi.

U.S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ	Hind foot.
[illegible]	551	San Francisco Mountain, Arizona...........	Sept. 28, 1889	♀ ad.	780	130	170

Canis latrans Say. Coyote.

The Coyote is common in the Sonoran fauna, and is very destructive to young lambs and to fruit. Several were seen on the Painted Desert, one in the act of feeding on a watermelon at the Moki pueblo of Moencopie.

In common with most carnivorous mammals the Coyote can not go many days without water. Woodhouse states that one was killed with a club at a small spring on the desert in western Arizona, where his party remained for two days. He says the Coyotes "became desperate, and would come to drink whilst the men and their mules were *standing there.*" Dr. Kennerly states that specimens of this Wolf collected at San Francisco Mountain had softer fur and broader skulls than those from the Missouri. (Pacific R. R. Repts. x, d, 11.)

Putorius sp. ——— ? Weasel.

Unmistakable signs of a Weasel were found on the summit of the mountain, just above timber line, but as no specimen was secured the species is uncertain.

Mephitis estor sp. nov. Skunk.

This Skunk is common about San Francisco Mountain, where a number of specimens were trapped in a ledge of rocks near Little Spring, on the line where the pine and Douglas fir zones meet (at an altitude of 8,200 feet). The limits of its vertical range were not ascertained, and I am unable to say whether or not it inhabits the Desert proper.

The North American Skunks are greatly in need of revision, the species being undefined and the synonymy hopelessly involved. I should not venture to add a new name to the list except for the fact that the present species can not be assigned to any already described. It may be known from the following description:

MEPHITIS ESTOR sp. nov.

[Skull, plate x, figs. 1, 2, 3, and 4.]

Type No. $\frac{17709}{24645}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From San Francisco Mountain, Arizona, August 17, 1889. Collected by Vernon Bailey (Original number, 369.)

Measurements (taken in flesh by collector).—Total length, 640; tail vertebræ, 256; pencil, 140; hind foot, 67. Ear from anterior base, 18; from crown, 8 (measured from dry skin).

General characters.—Size, small; tail, short, considerably shorter than head and body, and made up of hair of two lengths; ears, small; soles naked throughout, though the heel has the appearance of being haired because it is overlapped by the long hairs of its sides.

Color.—There is the usual white frontal stripe, narrow and barely reaching the nuchal patch, which latter begins in a straight line stretching completely across from ear to ear, occupying the whole occipital region and extending posteriorly in a broad white band, narrowing slightly over the shoulders and immediately expanding so as to cover the whole dorsal surface of the posterior half of the back and rump, inclosing a small, narrow streak of black along the middle of the rump (and this is wanting in some specimens, leaving the posterior back solid white), and thence passing continuously out over the tail, which it covers as a thin veil, allowing the black to show through, and projecting 90^{mm} beyond at the tip. The under parts are black, with irregular white patches on the throat [and breast in other specimens] and a white central area in the tail, which is produced by the fact that the basal half of each of the black hairs is white.

Cranial and dental characters.—Compared with a series of fifty skulls of *Mephitis mephitica* from northern New York, that of *M. estor* is narrower, the nasal portion of the face is less abruptly deflected, and the 'step' in the under jaw less sharply defined. The second and third upper molars are smaller, and the first lower molar larger. The post-palatal notch is anterior to the plane of the posterior edge of the alveolus of the last molar; there is no distinct pit between the audital bulla and post-glenoid process; the greatest breadth across mastoids is less than the distance from the foramen magnum to post-palatal notch; the greatest breadth across the supraorbital processes exceeds the interorbital breadth; the distance from the foramen lacerum posticum to the tip of the mastoid is not greater than the distance between canines; and the distance from the last lower molar to the condyle (in median line) is less than the length of the lower molar series.

In skunks, as usual in the *Mustelidæ*, the sutures disappear so early in life that the excellent characters which they afford are lost if adult skulls only are studied. Therefore, when seeking distinctive cranial characters, it is desirable to compare skulls of immature as well as adult animals.

In a young specimen of *Mephitis estor* (No. 25485) the nasals end in a narrow point exactly on the plane of the posterior borders of the maxillaries, and equal the parietals in length. The shorter, lateral portion of the nasals is less than half the length of the frontals. The basioccipital is unusually broad and short, its breadth between the carotid foramina equaling its length. In both *M. mephitica* and *M. occidentalis* the basioccipital is very much narrower. In both of these species, also, the audital bullæ are larger and less compressed laterally. In *M. estor* the post-palatal notch is truncated anteriorly, ending in a straight line; in *M. mephitica* it bears a blunt median spine, while in *M. occidentalis* it is narrowly notched in the median line. The great size of the molars in *M. occidentalis* is strikingly apparent in comparing young skulls with those of *M. estor* and *M. mephitica* of approximately the same age.

Mephitis estor may be distinguished at a glance from *M. macroura* by the shortness of its tail.

Record of specimens collected of Mephitis estor.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
[illegible]	*369	San Francisco Mountain, Arizona	Aug. 17, 1889	♂ ad.	640	256	
[illegible]	368	......do	Aug. 16, 1889	♀ im.	520	255	
[illegible]	370	.... do	Aug. 17, 1889	♀ im.	580	[illegible]	

*Type.

Spilogale gracilis sp. nov. Little Striped Skunk.

The Little Striped Skunks are characteristic members of the Sonoran fauna, and do not occur at higher altitudes than this fauna or its offshoots attain. They are rarely found far from water, and most of the species prefer rocky situations, often making their homes in crevices in cliffs.

While asleep near a small spring in the Grand Cañon of the Colorado, September 12, 1889, I was awakened at midnight by a sniffling noise about my head. Rising suddenly on my elbow, a small animal scampered hurriedly away over the rocks. His form was only dimly outlined in the dark, but a hasty shot left no doubt as to his identity, and a moment later I held in my hand the type of a new species of Little Striped Skunk. A day or two afterward a younger individual was captured among the cliffs at the top of the Cañon. The stomachs of both contained remains of the cliff mouse (*Hesperomys eremicus*). The new species may be known from the following description:

SPILOGALE GRACILIS sp. nov.

Type No. $\frac{17986}{24807}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Grand Cañon of the Colorado (altitude 3,500 feet), Arizona, north of San Francisco Mountain, September 12, 1889. Collected by C. Hart Merriam (Original number 451).

Measurements (taken in the flesh).—Total length 400; tail vertebræ 142*; hairs 100; hind foot 46.

General characters.—Longer and more slender than the eastern *S. putorius*, with a much longer tail. Frontal white patch much longer than broad, and rounded off both above and below; dorsal and lateral markings essentially as in *S. putorius*. Terminal part of tail white; the white occupying a little more than a third of the upper surface and two-thirds of the under surface.

Cranial and dental characters.—The skull of *Spilogale gracilis* differs widely from that of *S. putorius*. It is much flatter; the zygomatic arches are broader, and the fronto-parietal region is depressed to the general plane of the top of the cranium. The horizontal ramus of the under jaw is straight, while in *S. putorius* it is strongly convex below. The front of the upper sectorial tooth between the anterior and inner lobes is concave; while in *S. putorius* it is *straight*.

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*The tail of this specimen has been injured in early life and the terminal portion is absent. The tail vertebræ of a young individual caught at the Cañon measure 165mm.

Comparative measurements of Spilogale putorius, and S. gracilis, taken in the flesh.

	S. putorius.	S. gracilis.	
	17185 ♂ old	17986 ♂ old.	18568 ♂ im.
Total length	372	400	390
Tail vertebræ	129	142*	160
Tail pencil	60	100	106
Hind foot	39	46	46

* Tail short; tip gone.

Cranial measurements and ratios.

Measurements.	S. gracilis ♂ ad. type Grand Cañon, Ariz., No. 24897.	S. putorius ♂ ad. Lake Worth, Fla., No. 24117.
Greatest length of skull (from occipital condyle)	53.8	52.3
Basilar length of Hensel	47.0	46.5
Occipito-nasal length	50.5	48.5
Greatest zygomatic breadth	34.0	33.0
Greatest mastoid breadth	29.8	29.5
Breadth across postorbital processes	16.8	18.0
Least postorbital breadth	12.2	14.5
Greatest height of cranium from basisphenoid	16.5	17.8
Greatest height of cranium from palate	12.5	15.0
Greatest breadth across molars	18.4	18.5
Length of pterygoid fossa	10.8	11.0
RATIOS.		
Ratios to basilar length of Hensel:		
Zygomatic breadth	72.3	70.9
Palatal length	40.8	38.7
Height of cranium from basisphenoid	35.1	38.3
Height of cranium from palate	26.5	32.3
Length of pterygoid fossa	22.9	23.6
Breadth across postorbital processes	35.7	38.7
Breadth of postorbital constriction	25.9	31.1
Ratios to palatal length:		
Distance from foramen magnum to postpalatal notch	144.7	155.5
Distance across upper molars	95.8	102.7
Ratio of breadth to length of upper molar	131.9	139.1

Record of specimens collected of Spilogale gracilis.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
17339 24897	451	Grand Cañon, Arizona.	Sept. 12, 1889	♂ ad.	400	142	46	Type: Tail vertebræ injured and short.
18568 [illegible]	452	......do	Sept. 14, 1889	♂ im.	390	160	46	

Taxidea americana Boddaert. Badger.

The Badger is a common inhabitant of the Sonoran fauna, but does not extend up into the balsam zone. A single individual was observed in the pines about the middle of September.

Lutra hudsonica Lacépède. Otter.

Mr. Bailey found tracks of an Otter along the Colorado River at the bottom of the Grand Cañon in September.

Bassaris astuta Lichtenstein. Ring-tailed Cat.

This animal, to which the misleading name 'American Civet' has been applied, is common in places in the Grand Cañon, particularly near the mouth of Cataract Cañon. It is found also in the cañon of the Little Colorado, just below Grand Falls, as I was informed by a man who killed one there.

Ursus horribilis Ord. Grizzly Bear.

The Grizzly Bear has been reported by early writers from San Francisco Mountain, where both Woodhouse and Kennerly speak of it as abundant. Coues and Yarrow state that several were killed on the north slope of Bill Williams Mountain; and Mr. G. K. Gilbert tells me that his party killed one on the same mountain October 28, 1871.

Möllhausen, in his 'Diary,' says that when he passed New Year's Spring, at the south foot of Mount Sitgreaves, January 2, 1854, it was 'covered with thick ice." He says further:

> The numerous footprints of the grey bear which traversed the forest in all directions, tempted us to follow them. We examined the forest that lay to the south of us as well as that at the foot of Mount Sitgreaves and the neighboring hills, and we found dens in such numbers that if they had been tenanted we should have had a bear to every acre of land. The declivities and ravines of Mount Sitgreaves are, it seems, a particularly favorite residence with them, and even Leroux, old trapper and hunter as he was, did not remember to have ever met with signs of such numbers living together on so small a space; but, unfortunately, the whole company had migrated but a few days before our arrival. Probably the freezing of the water had occasioned this move, for we found on the ice marks of their having tried to break it. They seemed to have made their journey to the south in troops of eight or more, and their path was plainly recognisable on the glittering snow. (Vol II, p. 164-165).

Ursus americanus Pallas. Black Bear.

The Black Bear is common throughout the Boreal zones of the San Francisco Mountain region, and is particularly abundant on Kendrick Peak and some of the neighboring buttes. It is said to be common also in Oak Creek Cañon, where the effects of slope-exposure make up for the low altitude.

MAMMALS OF THE SEVERAL ZONES.

Arctic-Alpine Zone.—The Rocky Mountain Sheep (*Ovis canadensis*) and a species of Weasel (*Putorius* sp. ——?) are the only mammals known to inhabit the bare rocky summit of the mountain, and it is probable that they belong more properly to the subalpine or timber-line zone. Other species occasionally straggle up there; thus a single Say's Squirrel (*Tamias lateralis*), a Mountain Chipmunk (*Tamias cinereicollis*), and a Shrew (*Sorex monticolus*) were found just above timber line.

Boreal Zones (comprising the timber-line, spruce, and Douglas fir belts).—The characteristic mammals of these zones are the Porcupine (*Erethizon epixanthus*), Black Bear (*Ursus americanus*), Black-tailed Deer (*Cariacus macrotis*), Red Squirrel (*Sciurus fremonti mogollonensis*), Voles (*Arvicola mogollonensis* and *A. alticolus*), and Shrew (*Sorex monticolus*). All except the *Arvicolas* range from the top of the timber-line zone to the bottom of the Douglas fir zone. *Arvicola alticolus* inhabits the subarctic and Hudsonian (or spruce) zones, while *Arvicola mogollonensis* does not occur above the parks of the Canadian (or fir) zone.

In addition to the above-mentioned species, which so far as known are restricted to the Boreal Province during the breeding season, several others occur there which inhabit also one or more of the zones below. These are the Mountain Chipmunk (*Tamias cinereicollis*) which really belongs to the Boreal Province, though it ranges throughout the upper levels of the pine plateau area; Say's Chipmunk (*Tamias lateralis*), which extends up from the pines; Pocket Gopher (*Thomomys fulvus*); White-footed Mouse (*Hesperomys leucopus rufinus*); Wildcat (*Lynx baileyi*); Mountain Lion (*Felis concolor*), Skunk (*Mephitis estor*).

Pine Zone.—In the area next below the fir—the Pine Plateau area—there is but one distinctive mammal, and it, singularly enough, is a Squirrel—Abert's Squirrel (*Sciurus aberti*). Though this is the only mammal restricted to the Pine area, many others occur there. Say's Chipmunk (*Tamias lateralis*) here finds its center of abundance, though in common with the Mountain Chipmunk (*T. cinereicollis*), it ranges up through the Boreal zones. The following are common to the Pine and Sonoran regions: Antelope, Badger, Coyote, Round-tailed Wood-Rat, Rock Spermophile, Spotted Spermophile, and Prairie Dog. The two latter are found only in the openings or parks.

Piñon Zone.—The most characteristic mammal of the piñon belt is the Rock Squirrel or Spermophile (*Spermophilus grammurus.*) The Antelope also seems to find its center of abundance in this zone. Another characteristic species is the White-tailed Chipmunk (*Tamias leucurus cinnamomeus*), which comes up from the desert along with the Scorpion Mouse (*Onychomys fuliginosus*), Pocket Mouse (*Perognathus fuliginosus*), and Rabbits (*Lepus texianus* and *Lepus arizonæ.*)

Desert Area.—The most characteristic mammals of the desert region are Kangaroo Rats (*Dipodops*) and Pocket Mice (*Perognathus*), both of which are long-legged, long-tailed, jumping animals, provided with external cheek-pouches, and strictly nocturnal in habits. Other desert animals are the Big-eared Mice (*Hesperomys eremicus* and *H. megalotis*), Free-tailed Bats (*Nyctinomus*), and the Pigmy Bat (*Vesperugo hesperus*).

PART IV.—ANNOTATED LIST OF BIRDS OF THE SAN FRANCISCO MOUNTAIN PLATEAU AND THE DESERT OF THE LITTLE COLORADO RIVER, ARIZONA.

By Dr. C. HART MERRIAM.

Colymbus nigricollis californicus. Eared Grebe.

A Grebe, probably of this species, was seen in a small pond in Tanner's Gulch, a few miles north of Moencopie, during the latter part of September. Recently it has been recorded from Mormon Lake and "a small lake near Flagstaff" by Dr. E. A. Mearns (Auk. VII, Jan. 1890, 50.)

Anas boschas. Mallard.

A large number of Mallards were seen, and several shot, on a small pond in Tanner's Gulch, north of Moencopie, September 23.

Anas americana. Baldpate.

Recorded by Dr. Mearns as common at Mormon Lake, about 20 miles south of San Francisco Mountain.

Anas discors. Blue-winged Teal.

Six were seen at a small pool in a park in the balsam belt August 30. At Hull Spring, September 9, a large flock (fifty or more) was found squatting in the mud below the spring, and seven were killed at one shot by Vernon Bailey. I killed one and saw several others in a small pond north of Moencopie, September 23.

Spatula clypeata. Shoveller.

During the evening of September 23, when camped in Tanner's Gulch, north of Moencopie, I shot a Great Horned Owl, which had just alighted on a rocky pinnacle overlooking the pond, where he had doubtless come to feed on coots (*Fulica americana*). At the discharge of the gun a flock of ducks rose from the pond and circled over our small camp-fire. Dimly discerning them in the darkness I fired and a Shoveller fell dead at my feet.

Dafila acuta. Pintail.

Recorded from Mormon Lake by Dr. Mearns.

Erismatura rubida. Ruddy Duck.

Recorded by Dr. Mearns from both Mormon Lake and Duck Lake, near Flagstaff.

Plegadis guarauna. White-faced Glossy Ibis.

Breeds abundantly on Mormon Lake, about 20 miles south of San Francisco Mountain, as I was informed by several persons. Recorded also by Dr. Mearns. Woodhouse states that he obtained two specimens on the Little Colorado.

Botaurus lentiginosus. American Bittern.

"Especially abundant at Mormon Lake, where it finds a most congenial home."—Mearns.

Nycticorax nycticorax nævius. Black-crowned Night Heron.

Recorded by Dr. Mearns from Mormon Lake.

Grus mexicana. Sandhill Crane.

Recorded by Dr. Mearns from Mormon Lake.

Porzana carolina. Sora.

Found in the rushes in Tanner's Gulch, a few miles north of Moencopie, during the last week of September. Recorded by Dr. Mearns as abundant at Mormon Lake.

Fulica americana. American Coot.

Enormously abundant amongst the rushes in a small pond in Tanner's Gulch, a few miles north of Moencopie. There must have been thousands of them in this place at the time of our visit, September 23, 24. A dozen or more could be killed at a single shot at almost any time. Their flesh is excellent. Dr. Mearns records the species as breeding abundantly at Mormon Lake.

Phalaropus lobatus. Northern Phalarope.

A flock of eight, six of which were killed, was found in a little crater lake ('Walker Lake'), August 19.

Recurvirostra americana. American Avocet.

A flock of about twenty was seen August 13 near the Little Colorado River, in a small alkali pool, the result of a heavy shower. No others were observed.

Tringa bairdii. Baird's Sandpiper.

Five were shot August 27 in a small crater lake (Walker Lake), and two more at the same place September 1.

Tringa minutilla. Least Sandpiper.

Shot at a small crater lake August 27 and September 1 in company with *Tringa bairdii* and *Actitis macularia.*

Ereunetes pusillus. Semipalmated Sandpiper.

Shot September 1 at Walker Lake.

Totanus solitarius. Solitary Sandpiper.

One was shot August 26 at a little pool in a park in the balsam belt, and another at Walker Lake, September 1. No others were seen.

Actitis macularia. Spotted Sandpiper.

Shot August 27 and September 1 at a small crater lake (Walker Lake).

gialitis vocifera. Killdeer.

A single individual was found in a park in the pines near Flagstaff, uly 28, and a few were seen about the scattered pools in the bed of the ittle Colorado River, August 13 and 14. One was shot at a small ater lake (Walker Lake), August 27.

allipepla gambeli. Gambel's Partridge.

Gambel's Partridge does not inhabit the summit of the Great Plateau ough it reaches its edge from the south and west. It is found a ort distance west of Bill Williams Mountain, and is common in Cat act Cañon. The only evidence of its presence in the region of the ittle Colorado is Möllhausen's statement that "small partridges hopped out among the thick shrubs" bordering this stream when he crossed in December, 1854 (Möllhausen's Diary, II, 1858, 143).

ndragapus obscurus. Dusky Grouse.

Mr. John Swinburne, of Shona Ranch, St. John's, Arizona, visited our mp early in September, and climbed San Francisco Mountain Sep- mber 3. He informs me that he saw a Dusky Grouse in the spruce lt on the mountain. He is perfectly familiar with the species, and I ink there can be no doubt as to the correctness of the identification.

eleagris gallopavo mexicana. Mexican Turkey.

Common. In August they were feeding on gooseberries in the bal- m belt; in September they were feeding on piñon nuts in the cedar lt.

The northward distribution of the Turkey is said to be limited by the rand Cañon of the Colorado. This may be due to the greater eleva- on of the Kaibab Plateau which is in the Canadian fauna, its prevail- g forest being Douglas fir instead of pine.

lumba fasciata. Band-tailed Pigeon.

There is something remarkable about the occurrence of this species the San Francisco Mountain region. It was recorded as common by oodhouse, who found it in small flocks in October, 1851; and Dr. earns states that he found it common about the base of San Francisco ountain in May and June. It was not seen at all by our party.

naidura macroura. Mourning Dove.

Common from the Desert of the Little Colorado to the upper limit of e pine belt. Every evening they assemble at the springs and water les, coming in greatest numbers just at dark, particularly about the rders of the Desert where water is very scarce. On the evening of igust 20 we camped for the night at a small spring about 5 miles west Grand Falls. At dusk hundreds of Doves came to drink, and con- ued coming until it was so dark that they could not be seen.

thartes aura. Turkey Vulture.

Tolerably common, particularly about Flagstaff and at the Grand ñon; seldom seen at San Francisco Mountain.

rcus hudsonius. Marsh Hawk.

Several were seen circling about some grass and bushes near a spring at Echo Cliffs September 22–24. One was seen at Tenebito Wash, about the middle of August, and another at Black Tank September 20.

Accipiter velox. Sharp-shinned Hawk.

Tolerably common about San Francisco Mountain, and at the Grand Cañon.

Accipiter cooperi. Cooper's Hawk.

Tolerably common, particularly at the Grand Cañon of the Colorado, where they used to watch a water hole, perched motionless on a neighboring pine, and pounce on the birds that came to drink. Shot an old female at Little Spring August 4, another August 6 at Kendrick Peak, and saw several others about the mountains.

Accipiter atricapillus. Goshawk.

Several seen on the mountain. One was shot and another seen in the act of drinking at Little Spring, at the lower edge of the Douglas fir belt. Dr. Mearns states that he saw an immature Goshawk near timber line on San Francisco Mountain, June 7, 1887.

Buteo borealis calurus. Western Red-tail.

A few probably breed, but none were observed until August 6, when they suddenly became abundant, remaining so until the latter part of September. I have never seen these hawks so unwary. They were easily approached either on horseback or afoot, and many were shot in the pines. They fed principally on Chipmunks (*Tamias cinereicollis* and *Tamias lateralis*), and occasionally captured the large Abert's Squirrel (*Sciurus aberti*).

Buteo lineatus elegans. Red-bellied Hawk.

A specimen of this Hawk was collected on the Little Colorado by Kennerly and Möllhausen in November, 1853.

Buteo swainsoni. Swainson's Hawk.

Rare; only two were seen during the season. One of these was shot August 30.

Aquila chrysaëtos. Golden Eagle.

The Golden Eagle breeds on San Francisco Mountain, where it was often seen. An adult was shot by Vernon Bailey, August 28, at a small pool of very cold water at timber line. Its stomach contained the remains of an Abert's Squirrel (*Sciurus aberti*). On the morning of August 7, a little after daylight, I saw two Golden Eagles perched in tall pines near Le Roux Spring, watching for Prairie Dogs. They allowed me to ride under the trees on which they were perched.

Falco mexicanus. Prairie Falcon.

A pair of these Falcons had their nest on a high cliff in the crater of the main peak of San Francisco Mountain, and another pair had possession of a similar ledge on Kendrick Peak. Their loud cries may be heard a long distance. A specimen of this species was secured by Kennerly and Möllhausen on the Little Colorado in November, 1853.

Falco columbarius. Pigeon Hawk.

Mr. F. Stephens writes me that he saw this Hawk at San Francisco *Mountain, near* Le Roux Spring, about the middle of July, 1887.

Falco sparverius. Sparrow Hawk.

Abundant throughout the piñon, pine, and spruce zones, and common in parts of the Desert where there were bushes for it to perch on. Feeds principally on insects.

Pandion haliaëtus carolinensis. Osprey; Fish Hawk.

Seen twice at the Grand Cañon about the middle of September.

Asio wilsonianus. Long-eared Owl.

Mr. F. Stephens writes me that he shot a specimen of this species at San Francisco Mountain, near Le Roux Spring, about the middle of July, 1887.

Megascops flammeolus. Flammulated Screech Owl.

At 3 o'clock in the morning of September 13, while climbing out of the Grand Cañon of the Colorado by moonlight, I shot one of these Owls. Its stomach contained a scorpion and some beetles and other insects. It was an immature female.

Nyctala acadica. Saw-whet Owl.

Dr. Mearns found a nest of this owl near Little Spring and secured the female parent. The nest contained one egg and three young, but the date is not given.

Bubo virginianus saturatus. Dusky Great Horned Owl.

This dark form of the Great Horned Owl has been heretofore regarded as limited in its range to the humid spruce forests of the northwest coast region from Oregon to Alaska, and thence easterly through the great northern spruce forests of Canada to Labrador; but no one seems to have suspected its existence in the Rocky Mountains. Comparison of San Francisco Mountain specimens with the U. S. National Museum series shows that they pertain to this form and differ widely from either *B. virginianus* of the East, or *B. subarcticus* of the Plains and arid lands of the West.

This Owl is common in the spruce and balsam belts of San Francisco Mountain. A specimen shot at the brink of the Grand Cañon of the Colorado differs from the mountain specimens in having considerable white on the feet.

A Great Horned Owl was shot at Tanner's Gulch, near Echo Cliffs, on the desert of the Little Colorado, September 23, but was not preserved.

Speotyto cunicularia hypogæa. Burrowing Owl.

Found on the higher mesas of the Desert of the Little Colorado, occupying deserted burrows of Prairie Dogs (*Cynomys gunnisoni*).

Glaucidium gnoma. Pygmy Owl.

Not obtained by our party. Dr. Mearns records it from San Francisco Mountain.

Geococcyx californianus. Road-runner.

Not observed by our party. Recorded by Dr. Kennerly, who states hat it was "seen occasionally during the winter along the Little Colorado River."

Ceryle alcyon. Belted Kingfisher.

A single Kingfisher was seen at Tanner's Gulch, a few miles north of Moencopie, September 23.

Dryobates villosus hyloscopus. Cabanis's Woodpecker.

Common in the pine belt.

Picoides americanus dorsalis. Alpine Three-toed Woodpecker.

Common in the spruce and balsam belts. A female was shot high up on the mountain August 23, feeding a full-grown young. A few were killed as low as the upper edge of the pine belt.

Sphyrapicus varius nuchalis. Red-naped Sapsucker.

Occurs during fall migration. First observed September 19, when Professor Knowlton shot an adult male near Little Spring. The next day, September 20, I shot an immature bird in the cedars, and September 23, saw another at Moa Ave. September 30, Professor Knowlton shot another male at Little Spring. No others were seen.

Sphyrapicus thyroideus. Williamson's Sapsucker.

Common in the Douglas fir belt and the upper part of the pines; probably breeds in the aspens. Both young and old were shot. Common in the pines at the Grand Cañon the middle of September.

Melanerpes torquatus. Lewis's Woodpecker.

Breeds in the piñon and cedar belt, where it is tolerably common; may breed in the lower part of the pine area also. Rather common at Cañon Spring on the south side of the Grand Cañon, where small flocks came to drink every day during our stay, about the middle of September. Young were shot at Turkey Tanks the middle of August.

Melanerpes formicivorus bairdi. Californian Woodpecker.

Found among the oaks near the Grand Cañon of the Colorado. Not seen elsewhere.

Colaptes cafer. Red-shafted Flicker.

Common in the pines.

Phalænoptilus nuttalli. Poor-will.

A colony of Poor-wills inhabited a ledge of rocks at the lower edge of the balsam belt, near Little Spring. They began calling just at dusk every evening. A young was shot August 1, and several adults afterward. A single Poor-will was seen at Tanner's Crossing on the Little Colorado, but whether it was the present form or the Frosted Poor-will (*Phalænoptilus nuttalli nitidus*) is uncertain. The same doubt pertains to specimens from the Moki villages recorded in the Report of the Ives Expedition.

Chordeiles virginianus henryi. Western Nighthawk.

Common about the mountain in summer, and on the Desert of the Little Colorado in August; not seen after the middle of September.

Micropus melanoleucus. White-throated Swift.

Flocks of White-throated Swifts were seen high up on the mountain and circling over the higher buttes in August and the early part of September. One was seen at the Grand Cañon September 10.

hilus platycercus. Broad-tailed Hummingbird.

ery abundant in the balsam belt and the upper part of the pine . A nest containing two nearly fledged young was found on the of a Douglas fir, about four feet from the ground, July 31. The cipal food plant of this Hummingbird is the beautiful scarlet trum- flower of *Pentstemon barbatus torreyi*. During the latter part of Au- t and early September, after it had ceased flowering, these birds e most often seen in the beds of the large blue larkspur (*Delphinium ulorum*). They wake up very early in the morning and go to water laylight no matter how cold the weather is. During the month of gust, and particularly the first half of the month, when the morn- were often frosty, hundreds of them came to the spring to drink bathe at break of day. They were like a swarm of bees, buzzing ut one's head and darting to and fro in every direction. The air full of them. They would drop down to the water, dip their feet bellies, and rise and shoot away as if propelled by an unseen power. y would often dart at the face of an intruder as if bent on piercing eye with their needle-like bill, and then poise for a moment almost hin reach before turning, when they were again lost in the busy ong. Whether this act was prompted by curiosity or resentment I not able to ascertain. Several were seen at the summit of the ntain during the latter part of August. They were found also at Grand Cañon of the Colorado, September 12–15. They began to ve the mountain during the first week in September, and none were after the middle of the month.

hilus rufus. Rufous Hummingbird.

ommon in the pines, feeding principally on *Pentstemon barbatus tor-* . Rarely seen as far up as the balsam belt. A few were usually among the multitude of Broad-tailed Hummers at Little Spring y morning in August, but they were more abundant lower down. r. Mearns records *Trochilus alexandri* as "a summer resident in zone of *Pinus ponderosa*" (Auk, July, 1890), but does not mention present species.

nnus vociferans. Cassin's Kingbird.

ather scarce. A few pairs breed in the parks in the pine belt, but species is much more common in the cedar belt and upper levels of Desert. A few were seen at the Grand Cañon of the Colorado about middle of September.

rnis saya. Say's Phœbe.

ound in the Desert of the Little Colorado and at the Grand Cañon eptember, frequenting patches of greasewood (*Atriplex canescens*) e former locality, and sage-brush (*Artemisia tridentata*) in the lat

Also common in the bushes bordering the Little Colorado at Tan- Crossing, September 21.

topus borealis. Olive-sided Flycatcher.

ommon in the *balsam belt*. Several broods of young were found *r in August.*

It is noteworthy that *Contopus pertinax*, which is common on the Santa Catalina and White Mountains, was not found anywhere in the San Francisco Mountain region.

Contopus richardsonii. Western Wood Pewee.

Abundant throughout the pines.

Empidonax difficilis. Western Flycatcher.

Common in the pines and in the lower part of the balsam belt.

Empidonax hammondi. Hammond's Flycatcher.

A few specimens were taken during the latter part of August.

Otocoris alpestris arenicola. Desert Horned Lark.

Common in flocks in the parks of the cedar belt, and tolerably common in the upper part of the desert, particularly in September.

Pica pica hudsonica. Magpie.

Not observed by our party but recorded from the Little Colorado by Kennerly, who procured a specimen there December 8, 1853.

Cyanocitta stelleri macrolopha. Long-crested Jay.

Abundant during August in the balsam and pine belts, and in September found everywhere from timber line to the lower part of the cedar belt.

Aphelocoma woodhousei. Woodhouse's Jay.

Common in the cedars and piñon, where it was seen at Turkey Tanks, at a crater east of O'Leary peak, and at the Grand Cañon of the Colorado. It is shy and difficult to procure.

Corvus corax sinuatus. Raven.

Common on the Desert of the Little Colorado, but not found about the mountain. Seen along the Rio Puerco, the Colorado Chiquito, Tenebito Wash, and Moencopie Wash. Found also at the Grand Cañon. A flock of about fifty individuals was seen near Hull Spring on a narrow tongue of the desert which projects far into the cedar belt between San Francisco Mountain and the Grand Cañon.

Corvus americanus. Crow.

Not common. A flock was usually found in the neighborhood of Fort Moroni, the headquarters of the cattle ranch.

Picicorvus columbianus. Clarke's Nutcracker.

Breeds commonly in the spruce belt, occasionally descending to the pines in summer. In September, when the piñon nuts were ripening, it came down from the mountain in flocks and was often seen in the piñon belt with the Piñon and Woodhouse's Jays. At the same time it was common at the uppermost limit of the dwarf spruce of the subalpine zone.

Cyanocephalus cyanocephalus. Piñon Jay.

Breeds abundantly throughout the piñon belt, of which it is one of the most characteristic species. Always seen in flocks; very noisy.

Agelaius phœniceus. Red-winged Blackbird.

Recorded by Woodhouse, who says of it: "I found them also in the *San Francisco* Mountain, near the Laguna Enematio."

Sturnella neglecta. Western Meadowlark.

A few pairs breed in the parks of the lower part of the pine zone. In he latter part of September it was tolerably common in the neighborhood of Moa Ave, near the north end of the Desert of the Little Colorado, and also between Black Tank and the cedar belt on the west side of the desert. None were seen in the desert proper.

Icterus bullocki. Bullock's Oriole.

Shot an immature bird in some tall bushes bordering the Little Colorado at Grand Falls, August 14.

Scolecophagus cyanocephalus. Brewer's Blackbird.

Tolerably common about Flagstaff, and seen occasionally in the cedar belt and in some of the parks in the pine belt. Several were seen in a bushy place near a spring at the south end of Echo Cliffs, September 22, and the species was common in the rushes in Tanner's Gulch, north of Moencopie, the last week in September.

Coccothraustes vespertina. Evening Grosbeak.

Breeds in the spruce. An adult female was killed at Le Roux Spring, July 29. The skin of her belly was thick and gelatinous, showing that she had only recently left the nest. Another was seen near Le Roux Spring, August 7, and an adult male was seen at Little Spring September 7.

Carpodacus mexicanus frontalis. House Finch.

Occasionally seen in small flocks in the pines. When camped at the Grand Cañon of the Colorado during the middle of September, small flocks of this species came to a pool to drink every day.

Loxia curvirostra stricklandi. Mexican Crossbill.

Tolerably common in the balsam belt, coming down into the pines in the latter part of summer. They may breed in the pines in early spring when the mountain is covered with snow. During our stay at the Grand Cañon, about the middle of September, they used to come every day to a small pool to drink.

Spinus psaltria. Arkansas Goldfinch.

Not common; a few were seen from time to time in the pines and at the Grand Cañon.

Spinus psaltria arizonæ. Arizona Goldfinch.

A few were seen at Flagstaff in September.

Spinus pinus. Pine Siskin.

Common in the balsam belt, where it breeds; common in the pines luring the latter part of summer.

Poocætes gramineus confinis. Western Vesper Sparrow.

Common in the parks in the pine belt and thence down to the upper evels of the desert. Common at the Grand Cañon September 10–16. Several were seen along the upper part of Moencopie Wash during the atter part of September.

Ammodramus sandwichensis alaudinus. Western Savanna Sparrow.

Found near Echo Cliffs late in September. Not noted elsewhere.

Chondestes grammacus strigatus. Western Lark Sparrow.

Common in the open parks in the cedar belt and occasionally found in the parks in the pines.

Zonotrichia leucophrys. White-crowned Sparrow.

Shot at the Grand Cañon the middle of September. First shot at the mountain September 19; afterwards tolerably common.

Zonotrichia intermedia. Intermediate Sparrow.

Common during migration. The first was shot in the pine belt, near Little Spring, August 31; afterward it was tolerable common until the end of September.

Spizella socialis arizonæ. Western Chipping Sparrow.

Abundant throughout the pines and cedars.

Spizella monticola. Tree Sparrow.

This species is a winter visitant from the far north and had not arrived at the time of my departure. Dr. Kennerly found it in December on the Little Colorado, "feeding upon the seeds of the grapes and weeds that grow along the valley."

Spizella breweri. Brewer's Sparrow.

Common on the Desert of the Little Colorado in summer, and found also in the cedar belt in early autumn. This species and *Amphispiza bilineata* were almost the only birds found on the Painted Desert proper in August.

Junco hyemalis oregonus. Oregon Junco.

A fall migrant, not seen until September 22, after which a few were seen.

Junco caniceps. Gray-headed Junco.

Woodhouse described *Junco caniceps* in 1852 from several specimens taken at different localities as wide apart as Mexico, Texas, and San Francisco Mountain. The bird from the latter locality is an immature female in fall plumage (collected October 14, 1851). It is not the same species as the males described on the same page. The latter come first in the description and I believe them to be *Junco cinereus* Swainson or *Junco cinereus palliatus* Ridgway.

Junco cinereus dorsalis. Red-backed Junco.

Breeds abundantly throughout the upper levels of the pine plateau region and in the balsam and spruce belts. At San Francisco Mountain in summer it is the commonest species of bird after *Sitta pygmæa*, and it was still abundant when we left the mountain, October 1. Spotted young were taken throughout August.

Amphispiza bilineata. Black-throated Desert Sparrow.

Tolerably common on the Desert of the Little Colorado; not seen elsewhere.

Amphispiza belli nevadensis. Sage Sparrow.

A spotted young was shot on the edge of a field near Flagstaff July 28. Others were seen along the Desert of the Little Colorado and at the Grand Cañon. It probably spends the whole year on the desert, for Dr. Kennerly states that he found it "in the month of December along the Little Colorado River, wherever the weeds and bushes were thick."

Peucæa ruficeps boucardi. Boucard's Sparrow.

Common in the Grand Cañon, where several were shot; found also on the Desert of the Little Colorado.

Melospiza fasciata fallax. Desert Song Sparrow.

This subspecies was shot at the Grand Cañon of the Colorado and along Echo Cliffs, near Moencopie.

Melospiza fasciata montana. Mountain Song Sparrow.

Two specimens of this subspecies were shot at Little Spring September 6, and another September 27. Others were seen near the same ocality during the latter part of August.

Melospiza lincolni. Lincoln's Sparrow.

Tolerably common in weeds in the pine belt early in September; first shot September 7. Two were shot and others seen at the Grand Cañon about the middle of September.

Passerella iliaca schistacea. Slate-colored Sparrow.

Dr. Leonhard Stejneger shot one at the north foot of San Francisco Mountain September 29. No others were seen.

Pipilo maculatus megalonyx? Spurred Towhee.

Several were seen in the scrub-oak at the Grand Cañon of the Colorado about the middle of September.

Pipilo chlorurus. Green-tailed Towhee.

Common in the pines during migration, and also in the bushes along the Little Colorado. It probably breeds near the mountain, where an immature bird was shot in the pines August 5.

This species was very abundant at the Grand Cañon of the Colorado during the middle of September, and its habit of searching for food on the ground led to the death of several individuals which got into our traps set for Mice and other small mammals. It was seen at Echo Cliffs late in September.

Habia melanocephala. Black-headed Grosbeak.

Several were shot in the pines. It was rather common at the Grand Cañon of the Colorado about the middle of September.

Piranga ludoviciana. Louisiana Tanager.

Breeds commonly in the balsam belt, where both young and old were taken in early August. They were in the habit of coming to Little Spring to drink every morning during the early part of our stay. A young of the year was shot in the Grand Cañon, September 13.

Piranga hepatica. Hepatic Tanager.

Probably breeds in the lower levels of the pine belt east of O'Leary Peak, where an adult male was shot and others seen September 4 and [illegible]. An immature male was shot in the pines near Little Spring August 1, and an adult female September 7.

The first specimen of the *Hepatic* Tanager secured within the United

States was killed at San Francisco Mountain by Dr. S. W. Woodhouse, naturalist of the Sitgreaves Expedition, in October, 1851. Dr. C. B. R. Kennerly states that he saw it at San Francisco Mountain in December, 1853.

Progne subis. Martin.

Dr. Mearns records this species as common in the pine plateau region. We did not find it.

Petrochelidon lunifrons. Cliff Swallow.

Several were seen at Grand Falls, on the Little Colorado, August 14, and a number of deserted nests were found on the sandstone cliffs on the east bank of the river. Not seen elsewhere.

Chelidon erythrogaster. Barn Swallow.

Several were seen at Tanner's Gulch, north of Moencopie, September 24.

Tachycineta thalassina. Violet-green Swallow.

Common, particularly in the parks of the pine plateau.

Ampelis cedrorum. Cedar Waxwing.

One was shot, and several were seen at different times near a pool on the edge of the Grand Cañon about the middle of September.

Lanius ludovicianus excubitorides. White-rumped Shrike.

Common on the greasewood plains of the desert of the Little Colorado. Two were seen in the sage-brush and chaparral at the Grand Cañon, and one in a park in the pine belt.

Vireo gilvus swainsoni. Western Warbling Vireo.

Common in the pines.

Vireo solitarius cassinii. Cassin's Vireo.

Common in the pines during fall migration; first shot August 21. Two were shot at the Grand Cañon the middle of September.

Vireo solitarius plumbeus. Plumbeous Vireo.

Tolerably common; first shot August 31. Mr. F. Stephens writes me that he shot a specimen of this species and saw others near Le Roux Spring about the middle of July, 1887.

Vireo vicinior. Gray Vireo.

This species was not found except at the Grand Cañon of the Colorado, where a male was shot in a piñon September 14.

Helminthophila virginiæ. Virginia's Warbler.

Specimens were shot in the pines July 28 and August 17.

Helminthophila ruficapilla gutturalis. Calaveras Warbler.

Abundant during the latter part of August, particularly in the aspens; found also as high up on the mountain as the timber-line zone.

Helminthophlia celata lutescens. Lutescent Warbler.

A few were shot from August 29 to September 18, mostly in the tall pines and aspens.

Dendroica æstiva. Yellow Warbler.

Shot near Little Spring August 12, August 29, and September 3. *Tolerably common* in the cottonwoods along the Little Colorado River in August. Several were seen in a patch of reeds along Tenebito Wash in the desert, far from any trees, August 17; and in a thicket of bushes near a spring at the foot of Echo Cliffs late in September.

Dendroica auduboni. Audubon's Warbler.

Breeds abundantly in the balsam belt; common in migration throughout the timber-covered portions of the region.

Dendroica graciæ. Grace's Warbler.

First shot at the mountain August 12, and in the cedar belt August 13; afterward a few were taken in the pines; not seen after the last week in August.

Dendroica nigrescens. Black-throated Gray Warbler.

First shot August 12 in the pines; common until the middle of September. Found on the mountain as high as timber line, and also at the Grand Cañon of the Colorado.

Dendroica townsendi. Townsend's Warbler.

First shot on the mountain August 21; became common about August 28, and disappeared early in September. Found from the pines to the upper part of the timber-line zone. Shot at the Grand Cañon September 14.

Dendroica occidentalis. Hermit Warbler.

Common during fall migration, particularly from August 23 to September 1 in the timber-line zone. A few were killed as low down as the pines.

Geothlypis macgillivrayi. Macgillivray's Warbler.

One was seen at the base of Mount Kendrick August 6, and a female was shot near Little Spring August 14. No others were observed until August 22, when the species was tolerably common for a few days in some undergrowth along the edge of one of the parks in the pine belt. Three were shot and others seen in the Grand Cañon September 12 and 13.

Geothlypis trichas occidentalis. Western Yellow-throat.

One was shot and several seen in some thick weeds in the pine belt August 31, and others were shot in the Grand Cañon of the Colorado September 12 and 14.

Sylvania pusilla. Wilson's Warbler.

Abundant on the mountain during migration; first taken August 14; soon became abundant, outnumbering all the other Warblers; became scarce about the end of August; last seen early in September.

Anthus pensilvanicus. American Pipit; Titlark.

Probably breeds in the neighborhood of timber line on San Francisco Mountain, where it was shot by Mr. Bailey August 23. During migration it was seen at other places, and came to water at the little crater lake called Walker Lake, September 18, 22, and 25. Several were seen at Moa Ave, near the south end of Echo Cliffs, the last week in September.

Oroscoptes montanus. Sage Thrasher.

Occurs sparingly on the Desert of the Little Colorado; hardly more than half a dozen individuals were seen altogether.

Mimus polyglottos. Mockingbird.

Common at Grand Falls, on the Little Colorado.

Harporhynchus sp.—?

Two Thrashers were seen in the upper part of the Desert of the Little Colorado about the middle of August, but they were so shy that I was unable to approach within shooting distance, and consequently could not determine the species.

Salpinctes obsoletus. Rock Wren.

Common about rocky exposures everywhere from the Desert of the Little Colorado up to the top of San Francisco Mountain, and also at the Grand Cañon of the Colorado.

Catherpes mexicanus conspersus. Cañon Wren.

Tolerably common in the Grand Cañon and in the Cañon of the Little Colorado, where its marvelous song echoes and re-echoes until the towering cliffs fairly ring. One was shot on a ledge on the north side of San Francisco Mountain August 22, and several were seen among the lava rocks on the west side of the desert September 21 and 26.

Troglodytes aëdon aztecus. Western House Wren.

Tolerably common about the bottom of the Douglas fir belt in summer. Common in bushes bordering the Little Colorado during the latter part of September.

Cistothorus palustris. Long-billed Marsh Wren.

Common in the tall rushes in Tanner's pond, a few miles north of Moencopie.

Certhia familiaris montana. Rocky Mountain Creeper.

Tolerably common in the Douglas fir belt and the upper part of the pine belt.

Sitta carolinensis aculeata. Slender-billed Nuthatch.

Tolerably common in the tall pines and balsams; found also at the Grand Cañon during the middle of September.

Sitta canadensis. Red-bellied Nuthatch.

Recorded by Dr. Mearns from San Francisco Mountain; not secured by us.

Sitta pygmæa. Pygmy Nuthatch.

The most abundant and characteristic bird of the pine belt, to which it is probably restricted during the breeding season. In the fall it ranges up through the Douglas fir zone. It commonly moves in small flocks, and is one of the most familiar and affectionate of birds.

Parus inornatus griseus. Gray Titmouse.

Breeds commonly in the piñon belt, to which it seems to be restricted and in which it was encountered at various points from Turkey Tanks *to the Grand* Cañon.

Parus gambeli. Mountain Chickadee.

Breeds abundantly in the spruce and fir zones, and is tolerably common in the pines during the latter part of August and September.

Psaltriparus plumbeus. Lead-colored Bush-tit.

Tolerably common in the piñon belt; not seen elsewhere.

This species was described by Baird from specimens collected along the Little Colorado by Kennerly and Möllhausen in November, 1853. Dr. Kennerly states that it was found in large flocks among the scattered bushes along the river.

Regulus satrapa. Golden-crowned Kinglet.

Not observed by us, but recorded by Woodhouse from San Francisco Mountain, where he found it in October, 1851, associated with *R. calendula* and *Parus gambeli.*

Regulus calendula. Ruby-crowned Kinglet.

Common on the mountain, where it breeds in the spruce belt. It was tolerably common at the Grand Cañon the middle of September.

Polioptila cærulea. Blue-gray Gnatcatcher.

Common in the cedar belt and at the Grand Cañon of the Colorado. Two were seen in the greasewood along Moencopie Wash, late in September.

Myadestes townsendii. Townsend's Solitaire.

Breeds in the Boreal zones of San Francisco Mountain and Kendrick Peak. A spotted young was shot on Kendrick Peak, August 25. During migration it was seen as low as the cedar belt (September 16).

Turdus aonalaschkæ auduboni. Audubon's Hermit Thrush.

Breeds abundantly throughout the spruce and Douglas fir zones. Spotted young were shot August 1.

Merula migratoria propinqua. Western Robin.

Occasionally seen in the pines and along the lower part of the fir belt. A few were seen at Grand Falls on the Little Colorado the middle of August, and it was tolerably common at the Grand Cañon of the Colorado the middle of September.

Sialia mexicana. Western Bluebird.

Breeds abundantly in the pines, and was common in the cedars and piñon in early autumn.

Sialia arctica. Mountain Bluebird.

Breeds sparingly; rare until September 5, when it suddenly became abundant; afterward seen at frequent intervals until the end of the month, principally in the cedars.

PART V.—ANNOTATED LIST OF REPTILES AND BATRACHIANS COLLECTED BY DR. C. HART MERRIAM AND VERNON BAILEY ON THE SAN FRANCISCO MOUNTAIN PLATEAU AND DESERT OF THE LITTLE COLORADO, ARIZONA, WITH DESCRIPTIONS OF NEW SPECIES.

By LEONHARD STEJNEGER.

A.—REPTILIA.

Crotaphytus baileyi sp. nov. Plate XII, fig. 1.

Diagnosis.—Similar to *C. collaris* in coloration, but with at least two rows of interorbital scutellæ; supraoculars smaller; head narrower, and snout longer.

Habitat.—Western New Mexico, Arizona, Utah, Nevada, and northern Mexico.

Type.—U. S. National Museum No. 15821; Painted Desert, Little Colorado River, Arizona; September 26, 1889; Dr. C. Hart Merriam and V. Bailey, coll.

Synonymy.—*Crotaphytus collaris* Auct. part nec Say.

Crotaphytus collaris var. Bocourt, Miss. Scientif. Mexique, Zool., Rept., 3 livr., p. 155, pl. XVII *bis*, figs. 6, 6*a* (1874).

Bocourt seems to have been the first to notice the difference in the scutellation and proportions of the heads of the typical *Crotaphytus collaris* and the form here named *C. baileyi*, but owing to the fact that he only possessed a single specimen of the latter, with somewhat uncertain locality ("Mexico") he failed to recognize the full significance of the characters he so admirably describes and figures. The general similarity in the very striking coloration which in both forms is equally variable seems to have overshadowed the structural distinction between them.

The type of Say's *Agama collaris* came from the Verdigris River, near its junction with the Neosho River, Creek Nation, Indian Territory. I have therefore selected a specimen collected at the Verdigris River (U. S. National Museum, No. 9368) for comparison and illustration as typical of the species. (See pl. XII, fig. 2.)

The differences between the two forms are so well expressed in the figures accompanying this paper that a detailed description is quite unnecessary. Suffice it to say that I have found these characters to hold good in a collection of over seventy specimens from nearly thirty different localities in the West, due consideration being given to individual variation.

If we plot on a map the exact localities from which we have undoubted specimens (see map, pl. XIII) we shall find that our specimens of *C. collaris* hail from Kansas, Indian Territory, Arkansas, Texas, and eastern New Mexico, while specimens of *C. baileyi*, with definite localities, are at home in the western portion of the latter territory, in Arizona, Nevada, and northern Mexico. It will be seen that the two forms come very close together in New Mexico, but they belong to two different drainage systems, at least in the northern portion of the territory, and I do not believe that both will be found anywhere in the same locality.

There can consequently be no doubt that both forms are subspecies of the same species, but whether the form now named for the first time should receive a trinominal appellation or not is quite another thing, depending, according to the code of zoological nomenclature adopted by the American Ornithologists' Union,[*] which I adhere to in all my writings, upon the question whether the two forms are "now known to intergrade" or not.

In the collection before me there are a few specimens which present features which at first sight might seem to indicate intergradation. Thus No. 2725, collected by Dr. Kennerly "between Los Angeles and Rio Grande," and one of the specimens of No. 4958, Pecos River, Texas, Captain Pope, are quite alike as far as the interorbital scutellation is concerned, and neither are typical in this respect, inasmuch as both have a large interorbital, with a minute scale on the edge of it instead of either a large single one, or two smaller of equal size; but a comparison of the two specimens shows at once that the first mentioned one with the elongated snout belongs to *C. baileyi*, while the latter does not materially differ from the two typical *C. collaris* in the same bottle.

A specimen of No. 2715 is in every way similar to Dr. Kennerly's *C. baileyi* just referred to; two others in the same bottle seem to be typical of this form, while the remaining two are typical *C. collaris*. These specimens were collected by Möllhausen, under Lieutenant Whipple, "near Canadian," but it is quite significant that he crossed from the Canadian River into the territory exclusively inhabited by our new form, consequently across the boundary between the two.

It is quite possible that intergradation takes place, especially in southern New Mexico east of the Rio Grande, but until the fact shall have been proved conclusively I refuse to adopt a clumsy trinominal.

So far I have been unable to establish any difference in color between the two forms, though at one time I thought that *C. baileyi* had a better developed black collar usually connected on the neck, but the exceptions are too many to make this tendency available as a character.

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[*] Canon xi, The Code of Nomenclature, etc., adopted by the American Ornithologists' Union. New York, 1886.

During the second trip across the Painted Desert (September 21 to 6), Dr. Merriam collected seven specimens (Nos. 15821 to 15827) of arious sizes near the Little Colorado River. Several of them were nite fresh when brought to camp, and I had the opportunity to make , color sketch and the following description from a young individual No. 15824), the color designations referring to Ridgway's "Nomen- lature:"

Head above pale sepia, inclining to clay color; anterior portion of ipper neck in front of the first black collar pale blue, with several lon- ;itudinal marks of 'coral red;' space between the two black collars ale 'oil green,' with a narrow transverse collar of coral red; ground olor of back dull oil green, fading posteriorly on hind legs and tail to grayish 'pea green,' the back densely covered with rather large dark rayish olive blotches, which only allow the ground color to 'show hrough as a fine reticulation; the second black collar bordered poste- iorly with a wide line of 'lemon-yellow,' the back being crossed by ive similar lines, fading posteriorly and more or less alternating on the ateral halves of the body; tail with transverse bars of dark grayish rown; fore legs above 'apple green,' nearly yellow on the hand and aintly barred with the latter color; under surface pale greenish white, alms slightly pinkish, tail nearly white. Tongue deep pink; pharynx lackish carmine; palate ultramarine blue. Iris brassy greenish-yel- ow.

rotaphytus wislizenii B. & G.

The only specimen was collected near the Great Falls of Little Colo- ado River, August 18 (U. S. Nat. Mus., No. 15820.) It is a full-grown emale of the typical form.[*]

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[*] A comparison of Dr. Merriam's specimen with the material in the National Mu- :um, more than seventy specimens, led to the discovery that those of the Pacific rovince from central California northwards belong to a separate form which I pro- ose to characterize as

rotaphytus silus sp. nov.

Diagn.—Similar to *C. wislizenii*, but with the snout much shorter and more trun- ate in profile; greatest width of head equal to or greater than distance from nos- il to ear opening; distance between nostril and inner anterior orbital angle consid- ably less than vertical diameter of ear opening.

Hab.—San Joaquin Valley, California, to the State of Washington.

Type.—U. S. National Museum No. 11790 *♂*; Fresno, Cal.; Gustav Eisen, coll.

This form is not *C. gambeli* B. & G., the type of which (U. S. Nat. Mus., No. 2722) before me, showing all the typical features of *C. wislizenii*. As stated in the iginal description (Proc. Phila. Acad., VI, 1852-'53, p. 126) the exact locality of Gam- l's specimens is not known, but as they were collected by him during his trip to lifornia it has been surmised that they were from the latter State. Though this by no means certain, it is quite possible, for I suspect that the form occurring in e desert region of southern California will be found to agree with that of Arizona d New Mexico, *i. e.* the true *C. wislizenii*. Nor is it the same as *C. copeii* Yarrow, m which the new form differs in the same manner as it does from *C. wislizenii*.

Uta stansburiana B. & G.

Three specimens in excellent condition (U. S. Nat. Mus., Nos. 15842-15844) were collected in the Painted Desert, near the Little Colorado River, September 21. These are in every way typical.

Four young specimens (Nos. 15845–15848) were secured in the Grand Cañon of the Colorado on September 12, about 500 feet above the bottom. These seem to have longer arms than typical examples, resembling in that respect *U. palmeri*,* but owing to their bad state of preservation it is impossible to come to any conclusion, though it is certain that they do not belong to the latter form. I made the following notes on their color while yet tolerably fresh:

Nos. 15846 and 15847: Above coppery drab with three longitudinal series of indistinct brown spots along the back, which is speckled all over with numerous bluish white dots one to three scales large; tail somewhat grayer with faint cross-bars of a slightly darker color, and a longitudinal dusky spot along the median line of each of the darker cross-bars on the anterior half of the tail; legs with faint dusky cross-bars; head more rusty on the crown inclining to greenish bronze on supraorbitals and the region between them; snout, dusky; under side whitish, flanks inclining to greenish; chin and throat sky blue with faint dusky marblings. No. 15845 is similar, but with fewer light specks on the back, and with numerous dusky dots particularly noticeable on the upper neck; whole head uniform coppery drab; cross-bars on tail more distinct; chin and throat whitish, slightly suffused with

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I have *C. silus* from the following localities:

U. S. Nat. Mus. No.	Locality.	Collector.	No. of specimens.
11790	Fresno, Cal	G. Eisen	6
11757	......do	......do	3
9581	Fort Tejon, Cal	W. M. Gabb	2
12771	Des Chutes River, Oregon	Captain Bendire	1

* **U. palmeri** sp. nov.

Diagn.—Similar to typical *U. stansburiana* and with the same dorsal lepidosis, the scales being small, tuberculate, and not carinated for their entire length, but much larger and with longer fore legs, the tips of which, when adpressed, reach to or beyond the insertion of the thigh; scales on edge of collar much smaller; large prefrontals about twice as large as the largest supraoculars; number of femoral pores about 17; about 30 dorsals in a head length; color (in alcohol) above uniform bluish drab, with numerous small whitish dots, two to three scales large, sprinkled over the body, and no dusky markings whatever; dark blue blotch behind axilla present, though rather indistinct.

Hab.—San Pietro Martir Island, Gulf of California.

Type.—U. S. National Museum, No. 16002; Dr. Edw. Palmer, coll.

Dimensions of largest specimen (♀): Total length (tail reproduced) 158^{mm}; head 15^{mm}, width of head 14^{mm}; snout to posterior gular fold 25^{mm}; gular fold to vent 48^{mm}; fore limb 33^{mm}; hind limb 52^{mm}.

bluish and marbled with purplish gray; upper and lower mandibles suffused with 'salmon color.'

Uta ornata B. & G.

After a careful examination of the material at hand I have come to the conclusion that there exists a well-marked difference between *Uta ornata* of Baird and Girard and *U. symmetrica.*

This difference, however, is not the one which would suggest itself upon a comparison of the original descriptions (for instance, as contrasted by Boulenger, Cat. Liz. Br. Mus., II, pp. 210–211, and quite naturally so) inasmuch as both forms have the median dorsal series much smaller than those immediately adjoining it on both sides. Judging from the original description of *U. ornata* one would imagine the dorsal lepidosis to be similar to that of *U. graciosa* (Hallowell), but I have Baird and Girard's types before me (U. S. Nat. Mus., No. 2750,* Rio San Pedro, Texas, J. H. Clark, coll.), which show conclusively that both forms in this respect are essentially on the same plan. That the original describers failed to point out this character was undoubtedly due to the fact that at that time they had only to compare their new species with *U. stansburiana* from which the characters given were quite sufficient to separate it.

The chief difference between the two forms seems to be one of proportions *U. symmetrica* being more slender and elongated, with much longer hind limbs, particularly tibiæ and toes. The males in both forms are slenderer than the females, but the difference is well marked if specimens of the corresponding sex are compared. As a rule the difference may be expressed thus: In *U. ornata* the hind leg is shorter than distance from posterior gular fold to vent; while in *U. symmetrica* the hind leg equals or exceeds the same distance.

Though arranged on the same plan with a series of smaller dorsals in the middle, there is, nevertheless, a well marked distinction between the dorsal lepidosis of the two forms; for in *U. symmetrica* the difference between the two kinds of rows is greater, and their arrangement more symmetrical and orderly, the keels of the larger ones forming four nearly continuous parallel lines, while in *U. ornata* the rows are not so perfect, the outer one being often very irregular, both in size and number, more or less interrupted, or in some places divided into two smaller rows. In one of the types, the male, there can hardly be said to be more than one row of large scales on each side of the smaller middle one.

U. ornata and *U. symmetrica* seem to affect different altitudes, the latter occurring in the lower arid and desert regions, while the former is found chiefly in the cedar belt† and above.

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* In the Mex. Bound. Surv. Rept., p. 7, the number is erroneously given as 2700, which belongs to a *Crotaphytus.*

† The horizontal distribution of *U. ornata* is as yet uncertain. In addition to the San Francisco Mountain specimens I have seen others collected near Fort Whipple,

Dr. Merriam collected one specimen (No. 15841) of typical *U. ornata* in the cedar belt of San Francisco Mountain (altitude about 6,800 feet) on September 5. There are two more specimens in the National Museum from the same mountain (No. 4275) collected by H. B. Möllhausen, under Lieutenant Ives.

Uta symmetrica Baird.

As already pointed out under the foregoing species, this one is quite distinct from *U. ornata*, and in its distribution is a lowland and desert form. Professor Baird's type (No. 2760) from Fort Yuma, seems to be lost, but I have an excellent series of sixteen specimens (No. 2744) from the same locality, ample material for establishing the characters of the species. The three specimens (Nos. 15838–15840) all males, collected by Mr. Bailey near the bottom of the Great Cañon of the Colorado River, altitude about 2,500 feet, agrée very well with these and are undoubtedly true *Uta symmetrica* as distinguished from *U. ornata*.

Two of the specimens were in good condition when brought into camp, and afforded me an opportunity to make the following notes on the fresh colors:

No. 15838. Ground color above grayish-drab, more pinkish on tail and along the middle line, with a series of eight 'herring-bone' cross-bars of dusky, growing pale posteriorly and including a light spot on the

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Arizona (Dr. Coues, No. 11881, seven specimens; Captain Carpenter, No. 15693). I refer to this form with some doubt a specimen (U. S. Nat. Mus., No. 15729) which I collected last year on the rim of Walnut Cañon near Flagstaff, Arizona (about 7,000 feet altitude). It is very peculiar in having the scales bordering the posterior gular fold considerably larger than any *Uta* I have seen, but as it agrees in proportions with *Uta ornata* from the same altitude and neighborhood, I refuse to regard it otherwise than an individual variation until other specimens shall have been obtained.

Two specimens from a widely distant locality, however, agreeing completely among themselves and differing from all the rest before me, though evidently belonging to the same group as *U. ornata*, will have to be diagnosed under a separate name as—

Uta levis sp. nov.

Diagn.—A band of about six longitudinal, somewhat irregular rows of enlarged and only slightly carinated scales along the middle of the back from the shoulders backwards; the two median rows smaller; no lateral line of enlarged scales or tubercles on body or neck; frontal divided transversely; tail much less than twice the length of head and body; length of hind leg considerably less than distance from posterior gular fold to vent; no dark spot behind axilla.

Hab.—Tierra Amarilla, New Mexico.

Type.—U. S. National Museum, No. 11474; Prof. E. D. Cope, coll.

This form, of which both male and female (Nos. 11474, 8554) were collected by Professor Cope at Tierra Amarilla, about 110 miles northwest of Santa Fé, New Mexico, at an altitude of about 7,800 feet, is easily distinguished from *U. ornata*, its nearest ally, by the absence of the lateral enlarged scales or tubercles, those on the dorso-lateral fold being scarcely perceptibly larger than the other dorsal granules; nor are there any pointed tubercles or cluster of tubercles on the neck. In addition to these characters the carination of the enlarged dorsals is rather feeble. As in typical *U. ornata* the hind legs are short and the dorsal scale rows very irregular. The color of both specimens above is uniform pale without the slightest trace of markings; the male has flank patches of a pale sky-blue (in alcohol).

middle line; the six anterior cross-bars are bordered behind by a narrow black line, and all, both in front and behind, by a whitish line which is broader behind than in front; on the sides several rows of indistinct pale spots, many of them bordered anteriorly by dusky; a narrow dusky line across the head between the eyes; an indistinct dusky line from nostrils through eyes to above ear; legs and tail with indistinct and irregular cross-bands of a lighter shade than the ground color; underside whitish, with an elongated patch of emerald green on the flanks and a more yellowish one on the middle of the throat. (Now, after having been in alcohol for more than half a year, the green of the flanks has changed to a faint sky-blue, and the yellowish throat patch has disappeared.)

The other specimen (No. 15840) is considerably smaller. It resembles the above, though a little darker and with the pattern more distinct; no green on flanks, and the throat patch pinkish-yellow (now disappeared).

Holbrookia maculata flavilenta Cope.

By this name Professor Cope recently designated some specimens from Lake Valley, New Mexico, and as I find all the western specimens differing from true *H. maculata* in much the same manner as described by him and being in need of a name for this western (west of the Rio Grande) subspecies, I adopt the above appellation, at least provisionally.

This is the form which Professor Cope formerly called *H. propinqua* (for instance: Proc. Phila. Acad. 1866, p. 303; Expl. W. 100 Merid, v. p. 601), a species which he has later restricted—and most properly so—to southwestern Texas. The New Mexican and Arizona specimens were left with *H. maculata* "subspecies *maculata*." Yet the differences between these specimens and typical *H. maculata* which originally led to their identification with *H. propinqua* do in reality exist, though they are difficult to express in words, but they do also intergrade, to some extent, necessitating the use of trinominals.

In order to properly identify the specimens brought home by Dr. Merriam, I was obliged to review the whole question of *H. maculata* and its various races, and I came to the conclusion that there are two main races, each with a special geographic color variety. I may tabulate them as follows, indicating at the same time their geographic distribution *in so far as I have been able to examine specimens* from undoubted localities.

A. Pointed snout and narrow anterior supralabials.

1. *Holbrookia maculata*, typical: Northern Texas, Indian Territory, Kansas, Nebraska, eastern Colorado.
2. *H. m. lacerata*: Central Texas.

B. Truncate snout and broad prominent anterior supralabials.

3. *H. m. flavilenta*: Western New Mexico, Arizona, except extreme southern portion.
4. *H. m. approximans*: Southern Arizona, parts of Sonora, Chihuahua and Coahuila.

H. lacerata I take to be only a color race of typical *H. maculata*. In outline of head, shape of labials, and proportions I can find no difference between the ♂ *H. lacerata* (No. 10160 Helotes, Texas; W. G. Marnock, coll.) and various males of the typical form. So far as coloration of the upper parts are concerned, *H. lacerata* is closely approached by three specimens from Neosho, Kansas (No. 4693), and in regard to the lateral spots it may be stated that they are present in all three examples belonging to the National Museum, though the original description expressly says: "No blue spots on the sides."

Both *H. approximans* and *H. flavilenta*, as here understood, differ from true *H. maculata* as exemplified by numerous specimens from the typical locality, the Platte River, in the more truncated outline of the snout, as seen from above, the greater width, height, and obliqueness of the supralabials, and generally, in the reduced number, consequently greater size and greater flatness of the scales on top of the snout. As a rule the hind feet of these western forms are longer, but proportions of feet and tail as compared with length of body vary to such an extent individually all over the range of the species that they are hardly available for purposes of identification.

H. approximans seems to differ from *H. flavilenta* chiefly, if not exclusively, in having the lateral dark spots placed a little further back and surrounded by more blue.

Dr. Merriam's specimens (U. S. National Museum, Nos. 15828–15837) were collected in the Painted Desert, some at Moencopie, but the majority near the Little Colorado River, between September 21 and 26. One is quite young, the others full grown, or nearly so.

Sceloporus clarkii B. & G.

Originally described from southern Arizona, and by subsequent collectors ascertained to inhabit the drainage basin of the Gila River as well as the lower Colorado valley. Dr. Merriam's discovery of its occurrence in the Grand Cañon of the Colorado River north of San Francisco Mountain materially extends the range of the species northward and adds another to the many southern forms which push their northern outposts up through this wonderful cañon. As one of the specimens was caught about 1,000 feet above the bottom of the cañon, it is quite possible that this species may extend at least as far as the mouth of the San Juan River, or across the border into Utah.

Of the two specimens collected (Nos. 15849, 15850) one is very young—head and body 38^{mm} long. Its coloration is very pronounced and differs considerably from that of the adults, except the head and upper neck. The rest of the upper surface is of a pale bluish drab, with very distinct blackish-brown cross-bars, those on one side of the back alternating with those on the other side; across the neck just in front of the shoulders there is a nearly complete brownish black collar, laterally bordered with pale yellow both in front and behind. In the other specimen, which is more than half grown, only a trace is left of the collar, consisting of a blackish spot on each shoulder bordered behind with pale yellowish.

Sceloporus consobrinus B. & G.

Like *Uta ornata*, the present species is confined to the Cedar belt of the plateau, where it is not uncommon. Four specimens were collected: No. 15854, San Francisco Mountain, August 25, 1889; No. 15853, in the Cedar belt north of the mountain, at an altitude of about 6,500 feet, September 9; and two (Nos. 15851–'2) near Cañon Spring, at the rim of the Grand Cañon, September 13 and 15. It is not found either in the cañon or in the desert.

Sceloporus graciosus B. & G.

A very young specimen (No. 15855), which was collected at Tanner's Gulch, Painted Desert, on September 24, I refer to this species, although it differs considerably in coloration from the full-grown specimens which I have been able to compare it with. The dorsal spots are represented by two longitudinal brownish bands, narrowly margined with black, bordering a median band of nearly the same width but of a beautiful sky-blue color; laterally the dark bands are again bordered by a white one of equal width; beyond this there is a wider dusky band, followed again on the sides by a narrower and less well-defined white band which is set off from the light under surface by a shade of dusky.

Sceloporus elongatus, sp. nov.

Diagnosis.—Head shields smooth; occipital comparatively small, but broader than parietals; two or three parietals on each side; two scales on canthus rostralis; supraoculars, one large row and three small subequal ones, two outer and one inner; five free scales in front of ear opening; dorsal rows nearly parallel; lateral scales but little smaller, in oblique rows; scales on shoulders large, connecting dorsals with brachials; dorsal scales keeled, pointed, with a well-pronounced notch on each side of the point, 47 to 51 scales between occipital and tail, 9 to 11 in a head length; femoral pores 16 to 18 on each side, not meeting medially; tail about eight times the length of the head; distance between base of fifth toe and extremity of fourth, including claw, less than distance from nostril to arm, and much more than from snout to posterior margin of ear; no color band across nape; no longitudinal color bands; males with dark blue patches on flanks and one on each side of throat, females similarly marked, but colors less vivid and less extended.

Habitat.—Painted Desert, Arizona.

Type.—U. S. National Museum, No. 15858; Moa Ave, Painted Desert, Arizona; September 23, 1889; Dr. C. Hart Merriam, coll.

Unable to identify the specimens brought home by Dr. Merriam from the Painted Desert with any of the numerous forms described, I have been obliged to introduce them under a new name. Although nearly related to several of the species already known it is not an intermediate form connecting any of them, as in slenderness it surpasses them all, the tail and hind legs being particularly elongated.

In the number of dorsal scales this form is intermediate between *S. consobrinus* and *S. graciosus*, though the number included in a head length is the same as in the former, but in the new form the scales are not so strongly carinated, the keel being lower and mostly confined to the terminal half of the scale. It also agrees with *S. consobrinus* in the distribution of the blue color on flanks and throat, but shares with *S. bocourtii* the peculiarity of exhibiting a similar coloration in the females and young, differing from the latter, however, in having a blue mark on each side of the throat instead of a single one on the middle of the throat. The coloration of the upper side, however, is more of the *S. undulatus* type; but it is much lighter, the dark undulating cross-lines are not so heavy, and there is no trace of longitudinal bands. Even in the very young specimen these color characters are well pronounced and identical with the adults.

Measurements (in millimeters).

U. S. National Museum No.	Collector.	Sex and age.	Locality.	Date.	Total length.	Snout to occiput.	Width of head.	Snout to vent.	Fore legs.	Hind legs.	Vent to tip of tail.	Remarks.
15858	Dr. C. Hart Merriam and V. Bailey.	♂ ad.	Moa Ave, Arizona.	Sept. 23, 1889	199	15	14	75	34	52	124	Type.
15859	....do	♀ ad.	....do	....do	197	16	13	73	35	50	124	
15856	....do	♀ ad.	Little Colorado River, Arizona.	Sept. 21, 1889	....	14	12	70	32	49	*77	
15857	....do	juv.	....do	Sept. 26, 1889	104	10	8	40	....	28	64	

* Tail reproduced.

Phrynosoma hernandesi (Gir.).

To avoid mistakes I may at once remark that this name is intended for the interior form usually designated as *Ph. douglassii*, or even *Ph. douglassii douglasii* (!), as distinguished from the northwest coast form known as *Ph. douglassii pygmæa*, for as it was upon the latter that Bell founded his *Agama douglassii*, it is plain that the dwarf species found in the territory drained by the Columbia River is entitled to the name *Ph. douglassii* without any further qualifying trinominal.

It is beyond the scope of the present paper to discuss in detail the status of all the forms which are more or less closely grouped around *Ph. douglassii*, but I may state in this connection that the examination of a very extensive material has convinced me of the necessity of recognizing at least four different forms, each with a definite and distinct geographical distribution, viz, the typical Ph. douglassii (=*pygmæa*) from Oregon and Washington; *Ph. hernandesi* (=*douglassii* Auct. *nec* Bell) from the wooded plateau region of Colorado, Utah, New Mexico, and Arizona; *Ph. ornatissimum*, from the desert region of the latter territories; and *Ph. brevirostre* (Gir. *nec* Cope), a small edition of *Ph. ornatissimum* from Wyoming and, in general, the drainage basins of the Yellowstone and Platte Rivers.

Of these, only *Ph. hernandesi* and *Ph. ornatissimum* concern us in the present connection.

After having discovered that *Ph. pygmæa* is only a synonym of typical *Ph. douglassii*, it remained to ascertain which name in the long list of synonyms would be available for the form so long known as *Ph. douglassii*. It was then found that Girard's types of *Ph. hernandesi* in the U. S. National Museum (Nos. 107, 198) are still extant and that they are identical with the plateau form here in question.

Fortunately, Girard's type of *Ph. ornatissimum* is also preserved (U. S. National Museum, No. 204), so that we have authentic bases for both names. It remains now only to point out the differences between these species, differences which may be more easily appreciated by an inspection of plate XII, figs. 3 and 4, drawn from specimens collected by Dr. Merriam.

In *Ph. hernandesi* the head is more pointed, the lateral outline being straight or even concave, against convex in *Ph. ornatissimum;* the spines both on head and body are considerably larger and more numerous; the occipital spines are more horizontal, sloping backwards and parallel with the temporal spines, hence the outline of the occipital angle when viewed from above is subdivided into three angles by the points of the occipital spines, while in *Ph. ornatissimum* the occipital spines are more erect so that they do not protrude backwards into the occipital angle which, besides, is considerably more shallow. In *Ph. hernandesi* the occipital spines are also placed much nearer to the temporal spines, the interval being less between the occipital spines and the apex of the occipital angle, while in *Ph. ornatissimum* they are situated about midway, there being a large opening between the occipital spines and the temporal ones. The spines on the dorsal surface are larger in *Ph. hernandesi*, especially the row on the neck running backwards from the tip of the occipital spines. *Ph. hernandesi*, moreover, seems to have a considerably longer tail, it being quite as long in the females as in the males of *Ph. ornatissimum* (the males as is well known having considerably longer tails than the females). There are also decided differences in coloration, in spite of the great individual variation in both species. Quite characteristic of *Ph. hernandesi* is the red color of the cephalic spines, while the rest of the head is more or less of a greenish or bluish gray.

Phrynosoma hernandesi has a range corresponding to that of *Uta ornata* and *Sceloporus consobrinus*, being chiefly confined to the cedar belt and the lower pine belt. It was collected by Dr. Merriam at various points on San Francisco Mountain at various altitudes from 7,000 to 8,500 feet, and I myself obtained specimens of the same form at Hull's Spring (6,000 feet alt.) and at the Cañon Spring. A melanistic form was found in the black lava beds east and northeast of the mountain. The following is a full list of the specimens brought home by Dr. Merriam:

U. S. Nat. Mus. No.	Sex and age.	Locality and altitude.	Date.
15799	♂ ad.	San Francisco Mountain, Arizona (7,000 feet)	Sept. 8, 1889
15800	♂ ad.	......do	Sept. 5, 1889
15801	♂ ad.	......do	Do.
15802	♂ ad.	......do	Do.
15803	♂ juv.	......do	
15804	♂ juv.	......do	Aug. 20, 1889
15805	♂ juv.	......do	Aug. 7, 1889
15806	♀ ad.	......do	Aug. 20, 1889
15807	♀ ad.	......do	Aug. 5, 1889
15808	♀ ad.	......do ......(7,000 feet)	Sept. 5, 1889
15809	♀ ad.	......do	Aug. 17, 1889
15810	♀ ad.	......do ......(8,500 feet)	Aug. 8, 1889
15811	♀ ad.	......do ......(7,000 feet)	Sept. 5, 1889
15812	juv.	......do	Aug. 27, 1889
15813	juv.	......do	Aug. 25, 1889
15814	♂ juv.	Black lava beds east of mountain	Aug. 19, 1889
15815	♂ juv.	Black lava beds northeast of mountain	Sept. 26, 1889

Much has been written in regard to the perfection with which these animals 'imitate' the color of the ground on which they live, and our own observations fully verified the statement that they afford one of the most striking examples of protective mimicry. In the cedar and pine belts of the San Francisco Mountain the dark brown color of the soil and stones covering the surface is closely matched by the ground color of the *Phrynosomas*, while the greenish gray and orange colored markings which somewhat irregularly adorn their backs are perfect imitations of the lichens covering the rocks and pebbles among which these odd-looking creatures live. Near the rim of the Grand Cañon of the Colorado, on the other hand, the ground is covered with small pebbles of variously colored sandstone, ranging from a clayey white to brick red and dark brown, and the specimen which I collected there (No. 15724) is such a faithful reproduction of the surroundings that it would undoubtedly have remained undetected had it not been moving. Even more remarkable are the specimens which Dr. Merriam collected in the black lava belt east and northeast of the mountain. One of these (No. 15815) was brought to camp alive, enabling me to make the following description of the fresh colors: "Ground color of upper side, *including head*, satiny black; light markings on median third of body dull 'Naples yellow,' abruptly changing into the yellow ochre of those on the sides; tips of most lateral spines white; tips of largest cephalic spines marbled with ocher; under side yellowish white, densely marbled with blackish; collar, light ocher yellow." In these specimens even the gloss of the black lava was imitated.

Phrynosoma ornatissimum (Gir.).

The differences between this species and *Ph. hernandesi* have been pointed out under the head of the latter. They seem to be constant, they are well pronounced in the adults, and there seems to be no intergradation, so that I see no reason for adopting a trinominal appellation.

As already alluded to, this species is a true desert form, and it was consequently found by Dr. Merriam only on his trips through the Painted Desert. The following specimens were secured:

U. S. Nat. Mus. No.	Sex and age.	Locality.	Date.
15816	♂ ad.	Painted Desert, Arizona	Aug. 17, 1889
15817	♂ ad.	Little Colorado Desert, Arizona	Sept. 25, 1889
[illegible]	♀ ad.	......do	Sept. 24, 1889
[illegible]	♀ ad.	Moencopie, Painted Desert, Arizona	Do.

Judging from these specimens the normal coloration of *Ph. ornatissimum* is a pale cinnamon rufous on the back, with large round black spots, surrounded by a pale yellow line; upper side of head including spines uniform cinnamon rufous of the same shade as the ground color of the back.

The relation between *Ph. hernandesi and Ph. ornatissimum* and their distribution offers a most interesting parallel to that observed between a number of species of rodents, as pointed out by Dr. Merriam on previous pages (see pp. 55, 56, 59, 60, 74).

Eutainia vagrans B. & G.

The only snake collected was found by Mr. Bailey in the crater of O'Leary Peak, 9,000 feet altitude, October 2. (No. 15798.) This was, moreover, the only snake seen during the entire stay of the party in the San Francisco Mountain * plateau, though a single rattlesnake was seen on the Painted Desert, near Tenebito Wash, by Dr. Merriam.

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*This is a fact well worth recording, for it tends to corroborate the statement that snakes, especially rattlesnakes, are becoming rare in many western localities where they were quite abundant not long ago. During a short stay in July, 1864, Dr. E. Coues collected quite a number of rattlesnakes belonging to no less than four different species, on the same mountain, where not one was seen by Dr. Merriam's whole party during a stay of two months. The species collected by Dr. Coues have been determined as follows: *Crotalus confluentus, molossus, lucifer*, and *scutulatus*. (Wheeler's Expl. W. 100 Mer., v., pp. 604–608.)

B.—BATRACHIA.

Amblystoma tigrinum (Green).

While we were sitting around the camp-fire in the evening of September 19, a salamander (U. S. Nat. Mus., No. 16179) was suddenly seen writhing in the hot ashes, having probably dropped off one of the burning logs. I follow Cope's authority in adopting the above name. San Francisco Mountain is the locality whence came the type of Hallowell's *A. nebulosum.*

The fresh colors above were dark olive and "straw-yellow" in about equal proportions; a ring round the eyes and upper lips tinged with reddish; under side of head whitish; of body, pale yellowish-gray; free portions of digits tinged with pink; iris dark hazel.

Bufo lentiginosus woodhousii (Gir.).

Two medium-sized specimens (Nos. 16181, 16182) were collected on September 24 at Tanner's Gulch, 3 miles north of Tuba City, Painted Desert. They are normally colored though rather light, especially the smaller one. The following color notes were taken from the fresh specimens: "Above pale olive-green with a somewhat lighter stripe down the middle of the back; tip of tubercles pale red surrounded by black rings; lower surface olive white."

Two other and much smaller specimens were obtained at Tanner's Crossing of the Little Colorado, September 22 (Nos. 16183, 16184). Although differing greatly from the former in coloration, I can find no other character to distinguish them. A colored sketch and description from the fresh specimens at the time are to the following effect: "No. 16183. Entire upper surface pale flesh color, suffused with buff on hands and feet; parotoids darker, nearly 'brick-red' except in the middle; all the tubercles of the same red color; each of the larger ones surrounded at the base by a circle of minute black specks; a narrow white stripe down the middle of the back; a few dusky annular marks on upper flanks and hind legs; under surface bluish-white; lower abdomen and inner side of hind limbs pale brownish-yellow; palms of the same color, but the inner surface of the fore limbs pinkish; iris brassy, densely clouded with dark mottlings, except a narrow inner ring which is bright metallic."

Professor Cope, in his elaborate work on the "Batrachia of North America" (Bull. U. S. Nat. Mus., No. 34, p. 282), as a reason for leaving Hallowell's *B. dorsalis* out of the synonymy, makes the following statement:

> There is nothing in the description nor in the figure to enable us to ascertain what species or subspecies is represented. The evidence is as much in favor of the specimen having been a *B. l. americanus* as a *B. l. woodhousei*, and no locality is given to assist in reaching a conclusion. The type specimen can not be found.

This is not so, for in the first place Hallowell gives the locality of the only specimen expressly as "San Francisco Mountain, New Mexico" (*i. e.*, Arizona), and in the second place mention is made of the shortness of the head ("Length of head, 8 lines; length of head and body, 3 inches," consequently "head 4.5 times in length"). Moreover, Girard, who afterwards examined and partly described the type specimen, simply changed the name because *B. dorsalis* was already preoccupied by Spix, and we are well warranted in regarding the only specimen brought home by Dr. Woodhouse as the type of *B. woodhousii*. Finally, Hallowell's type of *B. dorsalis*, so far from not being found, is one of the very specimens enumerated by Professor Cope, viz, No. 2531. The "Calif. Mts." in the original entry on the Museum record book is simply a slip for San Francisco Mountain, as is evidenced by the original parchment label still attached to the specimen, which reads:

> "*Bufo dorsalis* Hallowell, San Francisco Mountain, New Mexico. S. W. Woodhouse, M. D."

This also disposes of another statement by the same author (*op. cit.*, pp. 282–284) that Möllhausen's specimen from Canadian River (U. S. Nat. Mus., No. 2632) is the type. Girard, at the time of publishing the name *B. woodhousii* had only the "Sonoran" specimens from the U. S. Mexican Boundary Survey and Hollowell's type of *B. dorsalis*. Those from the Pacific Railroad surveys under Whipple came in later.

Bufo punctatus B. & G.

Four specimens (U. S. National Museum, Nos. 16185–16188) of this species were collected by Mr. Bailey at the bottom of the Grand Cañon, September 13, 1889. I took the following color description from one of the fresh specimens (No. 16185): "Above 'malachite-green' densely speckled with small dots of bright vermilion; limbs paler, dotted with vermilion and also with minute black specks which likewise occur on the flanks; region surrounding nostrils black; upper lips and whole under surface bluish-white, irregularly speckled with black; posterior part of belly and underside of thighs dark brownish flesh-color; soles, dull orange.

This is a southern species which extends northward along the Colorado River. Möllhausen collected it in the "Upper Colorado Region," which apparently means the region about the Little Colorado River.

Specimens collected: U. S. National Museum, Nos. 16185–16188.

Spea hammondii (Baird).

A single specimen (No. 16180) was collected by Dr. Merriam in the Painted Desert, August 18, 1889. The label is inscribed as follows:

> "Tenebito Wash: found in a hole in wet mud; this wash is dry most of the year."

Hyla arenicolor Cope.

An interesting color variety of this species was collected by Dr. Merriam about 1,000 feet above the bottom of the Grand Cañon of the Colorado, September 13, 1889; and Mr. Bailey obtained similar specimens at the bottom. These specimens, which were found on a very light-colored rock, the exact shade of which they matched, are remarkable for the nearly total absence of dark markings on the upper surface. They were brought to me fresh, so as to give me an opportunity to prepare the following description of the colors: No. 16189, 1,000 feet above bottom of Grand Cañon, Dr. Merriam, coll. "Iris pale brassy with black marblings. Above uniform frosted silvery, irregularly overlaid with a faint golden gloss which is more brassy on tympanum and sides of face; faint traces of dusky cross-bars on limbs, the light interspaces being pale golden; under side whitish, suffused with pinkish on fore neck, and with pale bluish-green on chin and (more intensely so) on middle of breast and belly; flanks posteriorly, as well as inner surface of limbs, bright and deep gamboge-yellow; under side of thighs and sides of belly more brownish-orange; digital discs pale orange-pink."

The specimens collected by Mr. Bailey were less metallic and more of a clayey color, except the tympanum, which was coppery; discs more purplish-pink; web of hind limbs bright gamboge-yellow. One of these (No. 16190) shows traces of the normal marblings of the species, the description from the fresh specimen being as follows: "Above clayey, with numerous slightly darker spots and well marked cross-bars of the same color on limbs; labial margins whitish; chin dark purplish-gray with whitish dots; breast whitish; belly bluish, gradually shading into yellowish behind; inner surface of limbs bright gamboge-yellow; thighs underneath more brown, speckled with whitish; digital discs pale flesh-color."

Specimens collected: U. S. National Museum, Nos. 16189–16194.

Rana virescens brachycephala. Cope.

Quite a number of these Frogs were obtained at Tuba City and Tanner's Gulch, Painted Desert, September 24, 1889, three of which were preserved (Nos. 16195, 16196, 16197). I have no doubt that) this is the species which Hallowell records under the name of *Rana areolata*, as collected by Dr. Woodhouse in the San Francisco Mountain.

FOREST TREES OF THE SAN FRANCISCO MOUNTAIN REGION, ARIZONA.

By Dr. C. HART MERRIAM.

The lofty pine forest of the San Francisco Mountain Plateau has been famous since the days of the early explorers, Sitgreaves, Kennerly, and Ives, who passed through it on their journeys across the continent.

It is a noteworthy forest, not alone on account of the size and beauty of the single species of tree of which it is composed (*Pinus ponderosa*), but also because of its openness, freedom from undergrowth, and its grassy carpet—for the porous lava soil supports a sparse growth of bunch-grass which is high enough after the rainy season sets in to conceal the rocky surface, and, at a little distance, to present the appearance of a meadow. The pleasing effect is heightened by the circumstance that the region can not be reached from any direction without first passing over a long stretch of arid desert.

The pine forest is thoroughly mature, nearly all the trees being of large size, and rarely crowded. Toward the desert it gives place to the juniper and piñon of the 'Cedar belt;' while on the mountains which rise above the plateau level it is invaded and finally superseded by other species. Most of the kinds of trees growing on San Francisco Mountain have been enumerated under the zones in which they occur; hence a brief notice of each will suffice.

Quercus gambelii Nuttall. Oak.

This is the only Oak met with by the expedition. It was seen in the neighborhood of Red Horse Tank, and thence to the Grand Cañon of the Colorado, and in small quantities near Walnut Cañon, but was not found at the mountain. It occurs as a rule in the form of scrub thickets not more than two or three meters in height, but a few large trees were seen near the Grand Cañon.

There is something remarkable respecting the history of this tree in the San Francisco Mountain region. Sitgreaves and other early explorers speak of it as abundant about the mountain, while we did not find it at all in the very places where it was formerly common. Its absence explains the absence of several species of birds which might be expected at the mountain, but which are rarely found except in oak scrub.

Populus tremuloides Michaux. Aspen; Quaking Aspen.

The Aspen is a common tree on San Francisco Mountain, where its normal vertical range is from a little below 2,500 to 3,000 meters (about 8,200 to 9,800 feet), though it descends considerably lower on northeasterly exposures. It is abundant on the pinnacle which caps the summit of Kendrick Peak. It grows on drier soil than Douglas fir and usually occupies the places from which the latter has been burned off, often forming large groves whose tall white trunks, as straight as arrows, attain a height of 25 meters (about 80 feet). It is worthy of remark that the common brake (*Pteris aquilina*) is usually associated with the Aspen, wherever found.

Populus monilifera Aiton. Cotton-wood.

The Cotton-wood grows sparingly along the Little Colorado bottom, where it is the only tree. It occurs also in places in the Grand Cañon.

Juniperus occidentalis monosperma Engelmann. Western Cedar; Juniper.

This is the tree from which the cedar belt takes its name. It is associated with the piñon, and is bounded by the desert below and by *Pinus ponderosa* above, ranging in altitude from 1,800 to 2,100 meters (6,000 to 7,000 feet).

Juniperus californica utahensis Engelmann. Great Basin Cedar.

This species was found at the Grand Cañon of the Colorado.

Juniperus pachyphlœa Torrey. Checker-bark Cedar; Alligator-bark Cedar.

This striking and handsome tree is rare in the San Francisco Mountain region, where it was observed in two places only, namely, at Walnut Cañon, and near the east base of Elden Mountain.

Abies concolor Lindley & Gordon. White Fir; Balsam Fir.

This fir is common in places at the Grand Cañon of the Colorado, where it occupies the uppermost zone on northerly exposures in company with *Pseudotsuga douglasii*. It was found by Mr. Bailey on the east side of Elden Mountain, but was not observed on San Francisco Mountain. The species is easily distinguished by the great length of its leaves, and by the balsam blisters on its bark, in this respect resembling the eastern *Abies balsamea*, and differing from all the other trees of the Plateau region.

Abies subalpina Engelmann. White Cork-bark Fir.

This beautiful fir, unique in the color and character of its bark, is one of the most conspicuous trees on San Francisco Mountain between the altitudes of 2,725 and 2,900 meters (8,950 to 9,500 feet). On the north side of a large butte, just south of Walker Lake crater, it descends to 2,600 meters (8,500 feet). The bark is a fine elastic cork of uniform texture, and free from hard particles. It averages about 6 millimeters in thickness and is very durable, frequently remaining intact while the wood rots away. Large pieces of it, still retaining their elasticity, may be stripped from dead trees and from logs upon the ground. It is sculptured by irregularly interrupted longitudinal depressions or grooves, and is ornamented by fine, parallel, wavy lines. Its color varies from creamy white to gray, and the surface has a velvety texture.

The leaves are short; and the scales of the large cones are deciduous while still on the tree. In fact, it was almost impossible to secure a perfect cone as early as the latter part of September.

I believe this tree to be distinct from true *A. subalpina*, but in the absence of material for direct comparison, I am unwilling to separate it.

On Kendrick Peak it grows from the south rim of the crater (altitude about 2,800 meters, or 9,200 feet) to the summit (a little above 3,050 meters, or 10,000 feet).

Pseudotsuga douglasii Lindley. Douglas Fir.

Douglas fir is the most characteristic tree of the Canadian zone of San Francisco Mountain, where it ranges from 2,500 to 2,800 meters (8,200 to 9,200 feet) in altitude. It is associated with *Pinus flexilis macrocarpa* and *Populus tremuloides*, though preferring moister situations. On the south side of both Agassiz and Kendrick Peaks the effects of slope-exposure carry it up nearly if not quite to 3,050 meters (10,000 feet). In a cold cañon on the northeast side of San Francisco Mountain, on the other hand, the effects of slope-exposure bring its lower limit down to 2,280 meters (7,500 feet); and it descends still lower in the crater on the northeast side of O'Leary Peak.

Picea engelmanni (Parry). Engelmann's Spruce.

Engelmann's Spruce reaches the uppermost limit of tree growth in company with *Pinus aristata*, and comes down to the upper limit of the Douglas fir zone, thus ranging in altitude from 2,800 to 3,500 meters (9,200 to 11,500 feet). On the south side of Kendrick Peak it was not observed below 2,950 meters (9,700 feet). Perhaps *Picea pungens* occurs with it, in which case the latter has the lower range.

Pinus flexilis macrocarpa Engelmann. White Pine.

This lofty pine, which equals or even exceeds *P. ponderosa* in size, occupies the lower zone of San Francisco Mountain, from about 2,500 to 2,775 meters (8,200 to 9,100 feet), occurring with Douglas fir and aspens. Along the upper part of the *Pinus ponderosa* belt it is mixed with that species. On the south side of Kendrick Peak it begins at about 2,680 meters (8,800 feet) and reaches the summit. Its nuts are much sought after, on account of their large size, by squirrels and chipmunks.

Pinus ponderosa Douglas. Yellow Pine.

As already stated, this species may be properly spoken of as the only tree of the San Francisco Mountain plateau, where its normal vertical range is from 2,100 to 2,500 meters (7,000 to 8,200 feet), though it extends irregularly to 2,675 meters (8,800 feet), mixing with the firs, aspens, and white pines. On the south side of Kendrick Peak the effects of slope exposure elevate its upper limit to an altitude of about 2,830 meters (9,300 feet); while on the south side of Agassiz Peak it reaches 2,775 meters (9,100 feet). It stretches southward from San Francisco Mountain to the plateau escarpment west of Baker Butte, and thence easterly along the crest of the plateau rim to the White Mountains, with no break of any considerable size, though near the White Mountains it is invaded by cedar and piñon.

Along the plateau escarpment *Pinus ponderosa* descends to a much lower altitude than elsewhere, being found as low as 1,370 meters (4,500 feet). This is due to the low altitude of base-level below the plateau.

The forest of *Pinus ponderosa* covering the Cocanini plateau, and commonly known as the 'Cocanini forest,' is separated from the San Francisco Mountain plateau forest by a wide belt of cedar and piñon (see Map 1). Another disconnected forest of the same kind occupies the high crest of the plateau west of Cataract Cañon. For this latter information I am indebted to Mr. John H. Renshawe, of the U. S. Geological Survey.

Pinus aristata Engelmann. Fox-tail Pine.

The Fox-tail Pine is a tree of high altitudes. On San Francisco Mountain it begins to appear at about 2,750 meters (9,000 feet), and ranges thence to timber line, vieing with *Picea engelmanni* to attain the greatest elevation on the rocky side of the peak, and thriving best in more open and slightly drier situations than its companion. It was not found on Kendrick or O'Leary Peaks. At the upper limit of its range (the timber-line zone), it is little more than a gnarled and prostrate bush, while lower down (in the Hudsonian zone), it is a large and handsome tree. Its large cones are usually dripping with clear, transparent resin.

Pinus edulis Engelmann. Piñon; Nut Pine.

The Piñon occurs in company with Junipers, the two together constituting the Piñon or cedar belt, which is the zone next below the pines. The altitude of the piñon belt is 1,800 to 2,100 meters (6,000 to 7,000 feet). The Piñon is more abundant in the upper than in the lower part of the cedar belt, and was common wherever we entered this belt from Walnut Cañon to the Grand Cañon of the Colorado, but the single-leaved form (*P. monophylla*) was nowhere met with, though it is accredited to the San Francisco Mountain region by Sargent in his volume on Forest Trees (Tenth Census, 1884, p. 190).

The Piñon is a prolific bearer, the quantity of nuts produced by the small and apparently distorted cones of a single tree being surprisingly large. They begin to ripen about the end of August, and constitute the most important indigenous food of the Indians as well as of many of the mammals and birds of the region.

TREES OF ESSENTIALLY COINCIDENT RANGE.

Between the summit of the mountain and the desert plain below, the following approximate coincidences in the vertical range of trees occur:

Pinus aristata Picea engelmanni	Approximate altitude, 2,800–3,500 meters, or 9,200–11,500 feet.
Psendotsuga douglasii Pinus flexilis macrocarpa Populis tremuloides	Approximate altitude, 2,500–2,800 meters, or 8,200–9,200 feet.
Pinus edulis *Juniperus occidentalis* monosperma.	Approximate altitude, 1,800–2,100 meters, or 6,000–7,000 feet.

NOTE.—The normal altitudes here given for the various trees of San Francisco Mountain are averages for the *west* side of the mountain. Favorable southern and southwestern exposures carry the zones up a hundred meters or more above these limits, while similar northern and northeastern exposures, particularly in gulches and cañons, deflect the zones as much as 200, or even 300 meters. The normal average difference in altitude of the same zone on the southwest and northeast sides of San Francisco Mountain is about 275 meters (900 feet).

RELATION OF A BIOLOGICAL SURVEY TO AGRICULTURE.

The primary object of mapping the geographic distribution of species is to ascertain the number, positions, and boundaries of the natural faunal and floral areas—areas which are fitted by nature for the existence of certain native animals and plants, and which consequently are adapted for the growth of certain agricultural products and for the support of certain kinds or breeds of stock. The obvious reason why certain animals and plants inhabit restricted parts of the earth's surface and do not occur in other parts, where there are no impassable barriers to prevent, is that such species have become adapted to the particular physical and climatic conditions there prevailing, and their sensitive organizations are not sufficiently plastic to enable them to live under other conditions.

The present biological survey of the San Francisco Mountain region has demonstrated that mammals, birds, reptiles, insects, and plants so coincide in distribution that a map showing the boundaries of an area inhabited by an association of species in one group serves equally well for other groups. The reason of this coincidence in distribution is that all terrestrial forms of life inhabiting the same area are exposed to the same surroundings and governed by the same general laws.

The point of greatest significance, so far as the practical agriculturist is concerned, is that what is true of animals and plants in a state of nature is true also of animals and plants as modified by the voluntary acts of man; for every race or breed of sheep, cattle, or swine, and every variety of grain or vegetable thrives best under particular conditions of temperature, moisture, exposure, and so on. It follows that a map of the natural life areas of a country will tell the farmer what he can expect to produce most profitably on his own farm, and also what crops will *not* thrive in his neighborhood, thus saving the time and cost of experimental farming, which, in the aggregate, amounts to hundreds of thousands of dollars every year.

Illustrations of the application of the principle here enunciated are not lacking, even in the arid region under consideration. Maps 1 and 2 are examples of the kind of biological maps here referred to, and may be used by the settler as guides in the selection of crops for particular localities. It is true that very little of the region embraced in the present report is under cultivation, partly because of its scanty water supply and partly because of its inaccessibility until opened up by the Atlantic

and Pacific Railway. Nevertheless, several crops and garden veget
bles have been grown successfully without irrigation, even in the Lit
Colorado Desert, and the beginning thus made indicates a natural grou
ing of agricultural products according to the zones here defined. T
Moki Indians cultivate successfully, in the arid valleys below the Pu
los, cotton, tobacco, peaches, melons, flax, gourds, and southern var
ties of corn and beans; and alfalfa grows luxuriantly in the same zo
N of these do well in the cooler climates of the higher zones.
s at agriculture in the Pine belt have developed the additio
hat wheat. potatoes, a variety of corn different from that of t
t and otl garden ld excellent results. The Ca
e Pine, is subject to early fros
ier crops; but turnips, beets, a
d to do w its lower border, and wild ra
eberries, and strawberrie abound in the Spruce belt.

area here mapped were ext nded so as to include the Gia
actus belt of the Gila and Salt River valleys, the range in agricultu
products would be far more striking, for then the orange, the date, a
the fig of the lower desert could be contrasted with the hardy cere
and the potato of the mountain plateau. These tropical fruits are n
grown near Phœnix, only 200 kilometers (125 miles) from San Francis
Mountain.

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"(1) Zone of Cactus, Yucca, and Agave; altitude, 3,000 to 3,500 feet ; grass is scanty. Where there is water, a most luxuriant vegetation springs up.

(2) Zone of Obione and Artemisia (Greasewood and Sage-brush) altitude, 3,500 to 4,900 feet. Grass is poor with few exceptions, on granitic and volcanic soil. The Cactus species are diminishing in number.

(3) Zone of *Juniperus occidentalis* (Cedar); altitude 4,900 to 6,800 feet ; Cactus species few.

(4) Zone of Pine and Fir, *6,800 to 10,800* feet (highest points)."

LOEW, Dr. OSCAR—Continued.

Loew's first zone does not reach the plateau, but extends far up the Grand Cañon, nearly if not quite to the mouth of the Little Colorado. His second and third zones are comparable respectively with the *Desert area* and the *Piñon* or *Cedar belt* of the present paper. The fourth zone includes everything between the Cedar belt and timber line, thus embracing the *Pine plateau* area, the *Douglas fir* zone, the *Spruce* zone, and the *Subalpine* or *Timber-line* zone.

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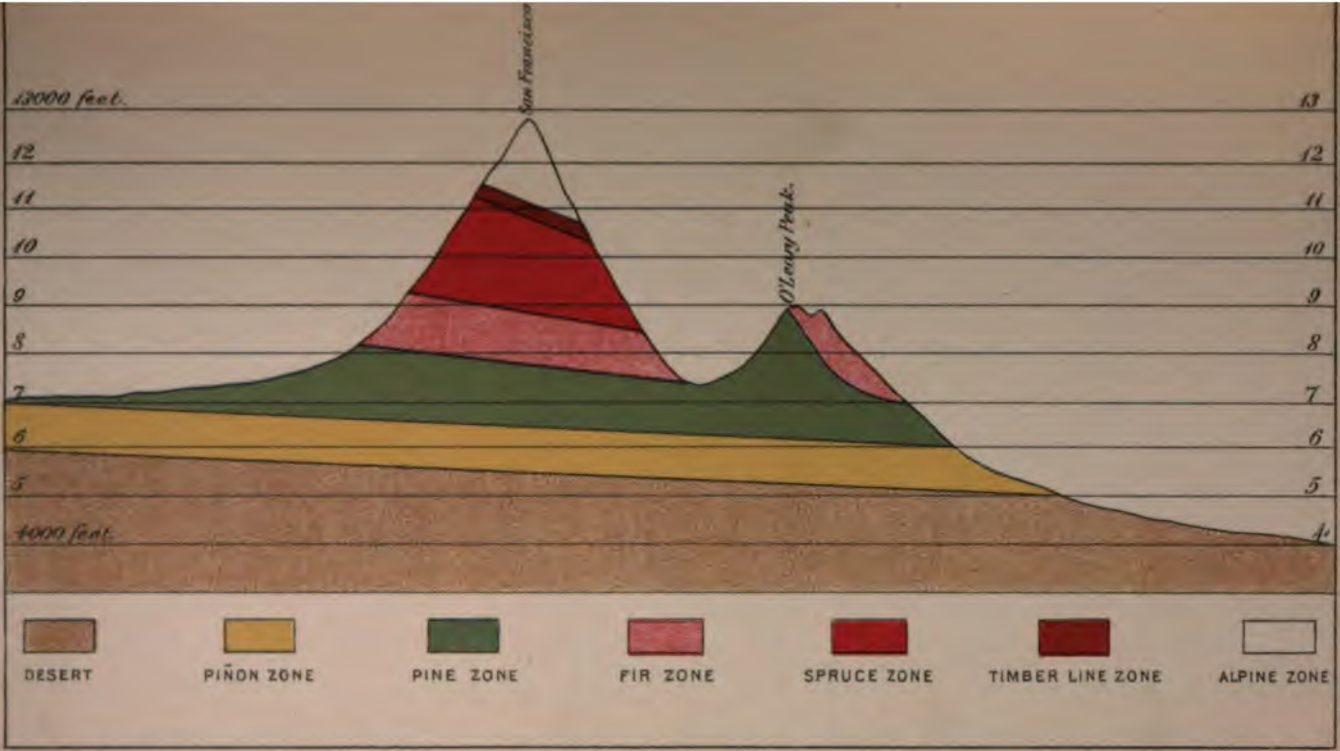
PLATE I.

**Diagrammatic profile of San Francisco Mountain and O'Leary Peak fro
west to northeast, showing the several life-zones and effects of slope-exposur**

Slope exposure is the inclination of the surface of the earth in relatio
angle of reception of the sun's rays. The sun strikes the northeast and east
a hill or mountain early in the day, before the heat is very great; the south
noon when the heat is greater; the southwest and west sides in the a
when the heat is greatest, and the northwest and north about sundown or n
It follows that the southwest side of a hill or mountain receives the sun's
nearly a right angle during the hottest part of the day, and consequent
hottest side. The higher temperature on the southwest side causes the zone
and conversely, the lower temperature on the north and northeast sides—th
exposures—causes them to dip down. The normal difference in altitude of t
zone on the southwest and northeast sides of San Francisco Mountain was
be about 275 meters, or 900 feet.

Plate 1.

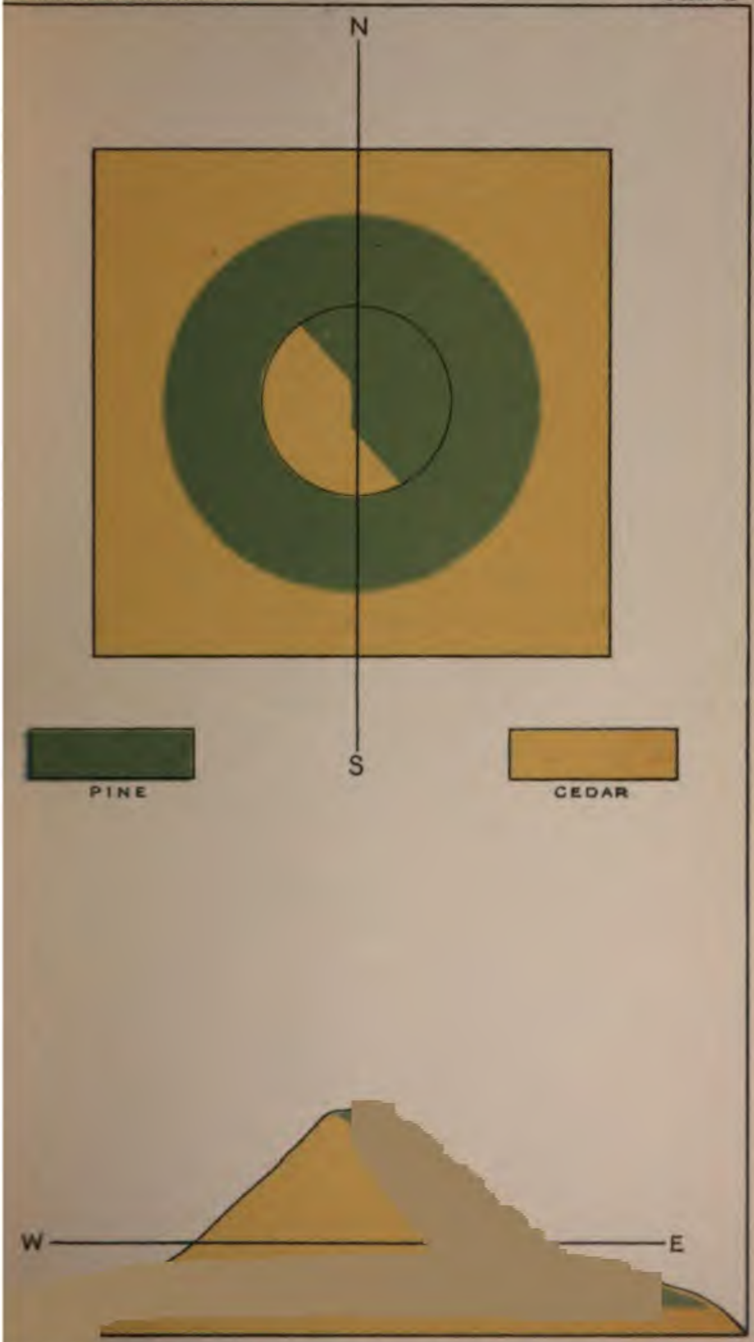


DIAGRAMMATIC PROFILE OF SAN FRANCISCO AND O'LEARY PEAKS FROM S. W. TO N. E., SHOWING THE SEVERAL LIFE ZONES AND EFFECTS OF SLOPE EXPOSURE.

PLATE II.

Diagram showing effects of slope-exposure on a volcanic cone north of San Francisco Mountain.

This cone is in the pine belt, its base being above the level of the piñon or cedar belt; yet its south and west slopes are covered with piñon and cedars to the exclusion of the tall pines which cover its north and east slopes as well as the surrounding plain. This is the result of *slope-exposure,* the sun's rays striking the south and west sides at such a sharp angle as to increase the temperature sufficiently to permit the growth of trees normally restricted to lower levels.



IAGRAM SHOWING EFFECTS OF SLOPE EXPOSURE ON A VOLCANIC *CONE NORTH OF* SAN FRANCISCO MOUNTAIN.

PLATE III.

Figs. 1, 2, 3, and 4, *Hesperomys megalotis* Merriam (No. $\frac{24843}{17943}$), ♂ ad. Painted Desert, Arizona. *Type*.

1. Crowns of left upper molars from below (×10).

2. Crowns of left lower molars from above (×10).

3. Crowns of left upper molars from the outside (×10).

4. Crowns of left lower molars from the outside (×10).

Figs. 5, 6, 7, and 8, *Hesperomys leucopus rufinus* subsp. nov. (No. $\frac{24584}{17648}$), ♀ ad. San Francisco Mountain, Arizona.

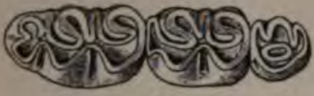
5. Crowns of left upper molars from below (×10).

6. Crowns of left lower molars from above (×10).

7. Crowns of left upper molars from the outside (×10).

8. Crowns of left lower molars from the outside (×10).

NOTE.—In this and the following plates the numbers in parentheses are those of the U. S. National Museum, unless the contrary is stated.



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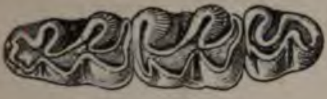

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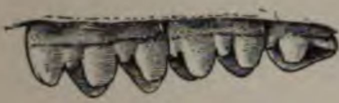

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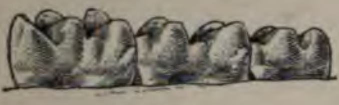

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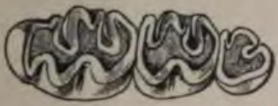

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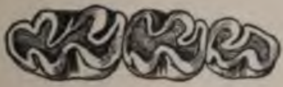

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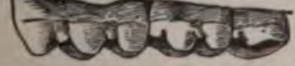

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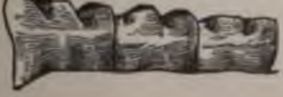

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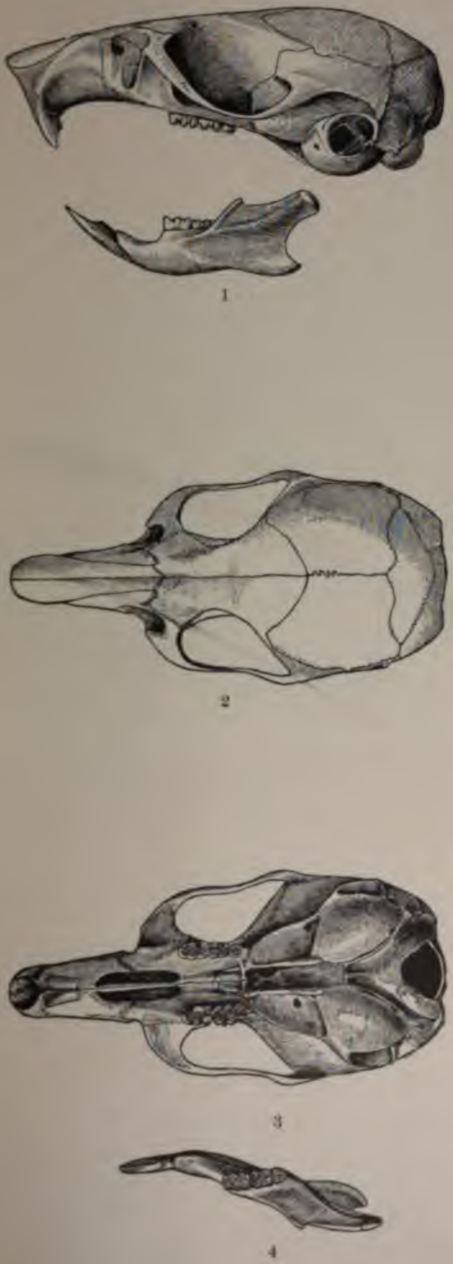
1-4. *Hesperomys megalotis sp. nov.*

5-8. *Hesperomys leucopus rufinus*

PLATE IV.

Figs. 1, 2, 3, and 4, skull of *Hesperomys megalotis* Merriam (No. [illegible]), Painted Desert, Arizona. *Type.*



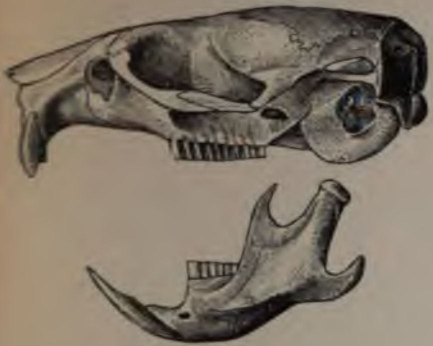
Hesperomys megalotis sp. nov.

PLATE V.

Figs. 1 and 2. Skull of *Arvicola alticolus* Merriam (No. $\frac{24561}{17615}$) ♀ ad. San Francisco Mountain, Arizona (×2).

Figs. 3 and 4. Skull of *Arvicola mogollonensis* Mearns (No. $\frac{24597}{17631}$) ♂ ad. San Francisco Mountain, Arizona (× 2).

Figs. 5, 6, and 7. Skull of *Perognathus intermedius* Merriam (No. $\frac{24586}{17975}$) ♂ ad. Grand Cañon of the Colorado, Arizona (× 1½).



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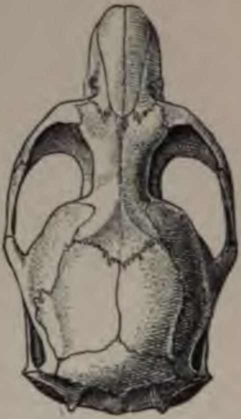

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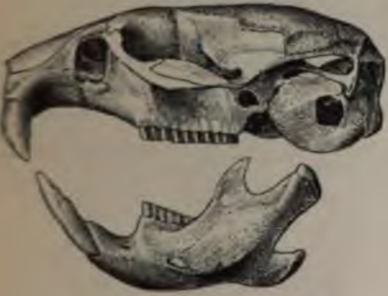

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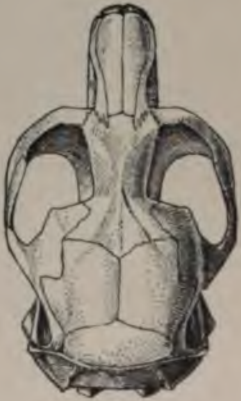

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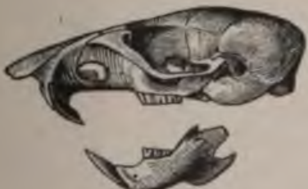

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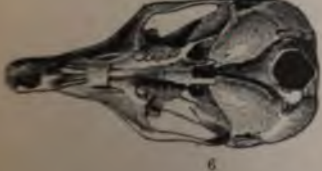

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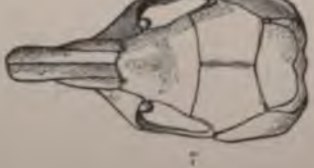


7

1, 2. *Arvicola alticolus* sp. nov.
3, 4. *A. mogollonensis.*

5, 6, 7. *Perognathus* (Chætodipus) *intermedius.*

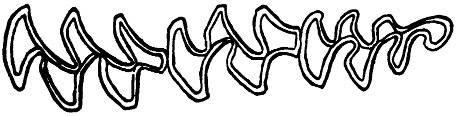
PLATE VI.

1, 2. *Arvicola alticolus* Merriam, ♀ ad. (No. $\frac{24561}{17615}$). San Francisco Mountain, Arizona. *Type.*
   1. Upper molar series.
   2. Lower molar series (×10).

3, 4. *Arvicola alticolus* Merriam, ♂ ad. (No. $\frac{24550}{17614}$). San Francisco Mountain, Arizona.
   3. Upper molar series.
   4. Lower molar series (×10).

5, 6. *Arvicola mogollonensis* Mearns, ♂ im. (No. $\frac{1402}{2381}$ Am. Mus. Nat. Hist.). Baker Butte, Mogollon Mesa, Arizona. *Type.*
   5. Upper molar series.
   6. Lower molar series (×10).

7, 8. *Arvicola mogollonensis* Mearns, ♂ (No. $\frac{24563}{17627}$). San Francisco Mountain, Arizona.
   7. Upper molar series.
   8. Lower molar series (×10).



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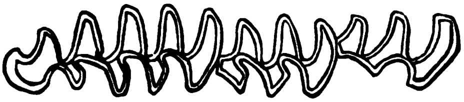

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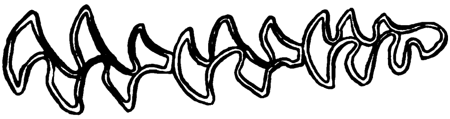

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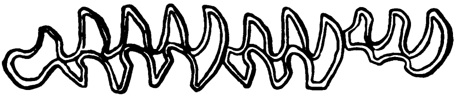

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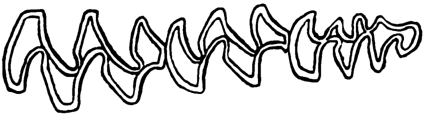

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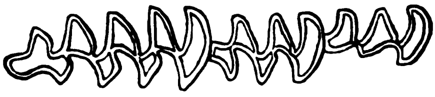

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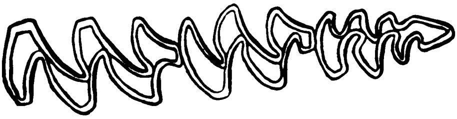

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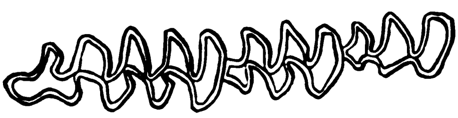
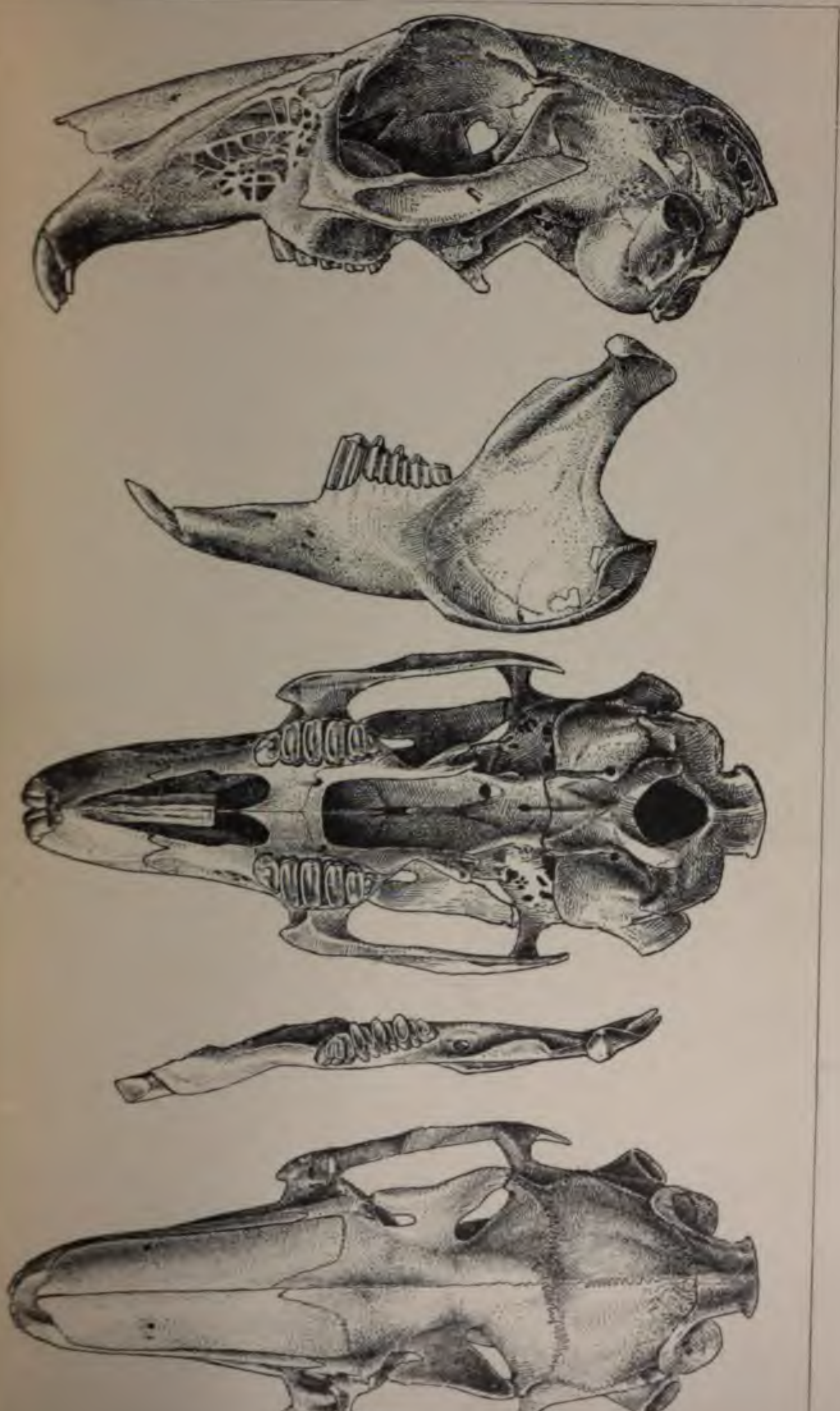


8

1-4. *Arvicola alticolus.* 5-8. *A. mogollonensis.*

PLATE VII.

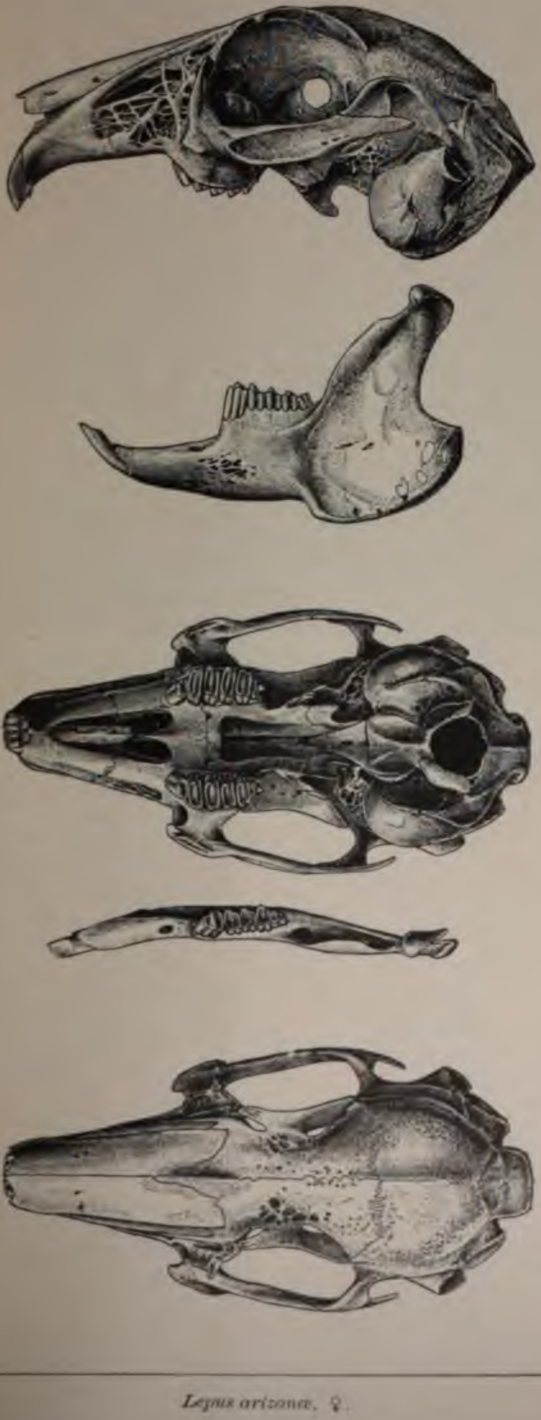
Skull of *Lepus texianus* Waterhouse (No. [illegible]), ♀ ad. San Francisco Mount Arizona. (Natural size.)



Lepus texianus, ♀.

PLATE VIII.

Skull of *Lepus arizonæ* Allen (No. $\frac{24611}{17667}$), ♀ ad. San Francisco Mountain, Arizona. (Natural size).

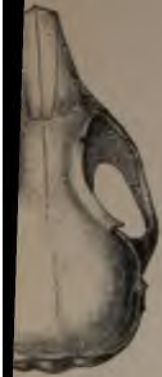


Lepus arizonæ, ♀.

PLATE IX.

Figs. 1, 2, and 3, skull of *Spermophilus cryptospilotus* Merriam (No. [illegible]), ♂ ad. Painted Desert, Arizona. *Type.* (1½ natural size.)

Figs. 4, 5, 6, and 7, skull of *Cynomys gunnisoni* Baird (No. [illegible]), ♀ ad. San Francisco Mountain, Arizona. (Natural size.)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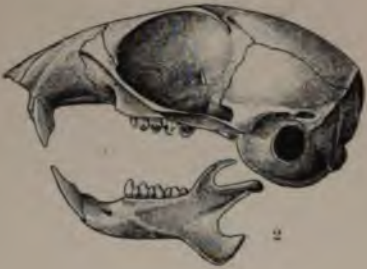
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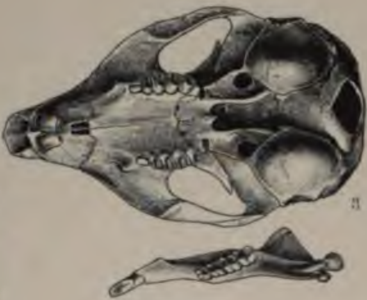
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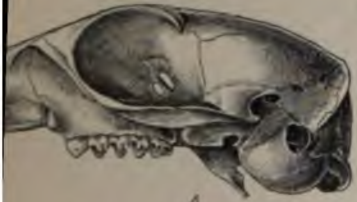

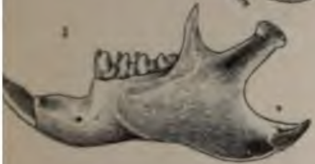
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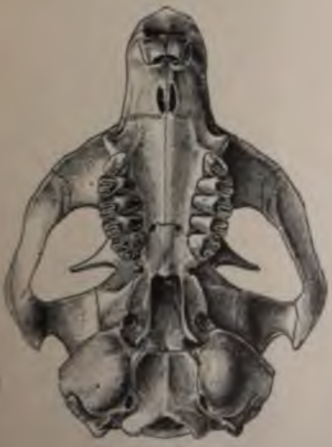
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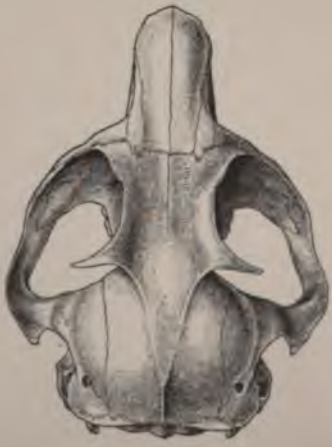
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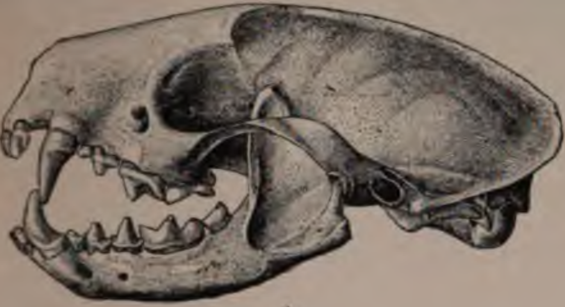
mophilus cryptospilotus sp. nov. (× 1½). 4-7. *Cynomys gunnisoni* (nat. size).

PLATE X.

Figs. 1, 2, 3, and 4, skull of *Mephitis estor* Merriam (No. [illegible]), ♂ ad. San Fran
Mountain, Arizona. (Natural size.) *Type.*

Figs. 5, 6, 7, and 8, skull of *Neotoma mexicana* Baird (No. [illegible]), ♂ ad. San Fran
Mountain, Arizona (natural size).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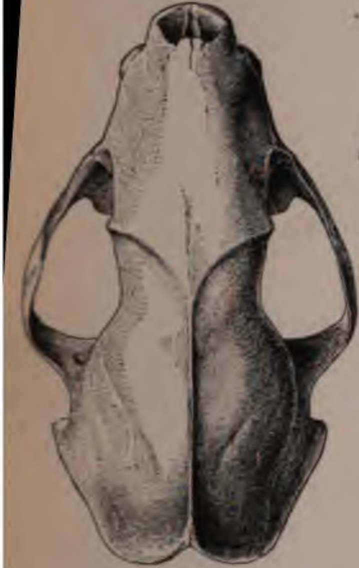
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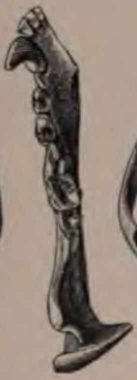
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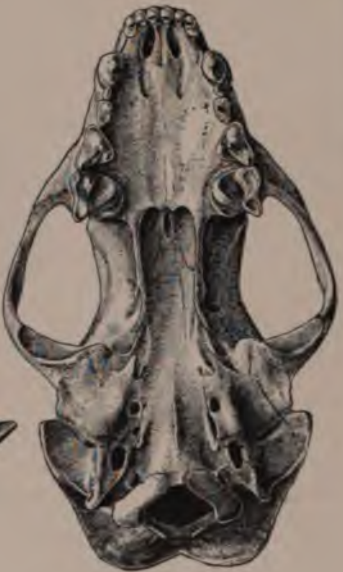
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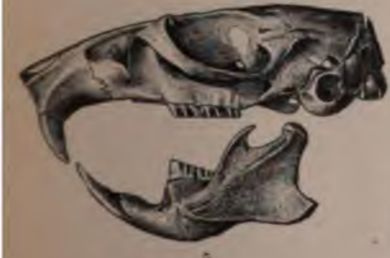
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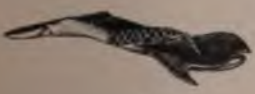
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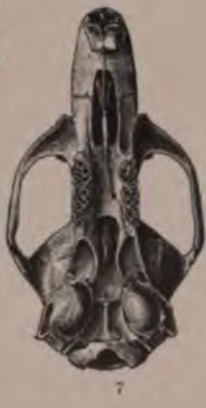
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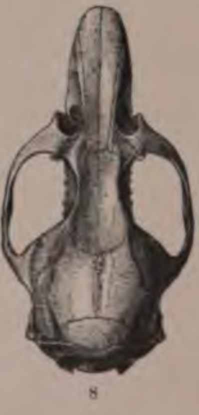
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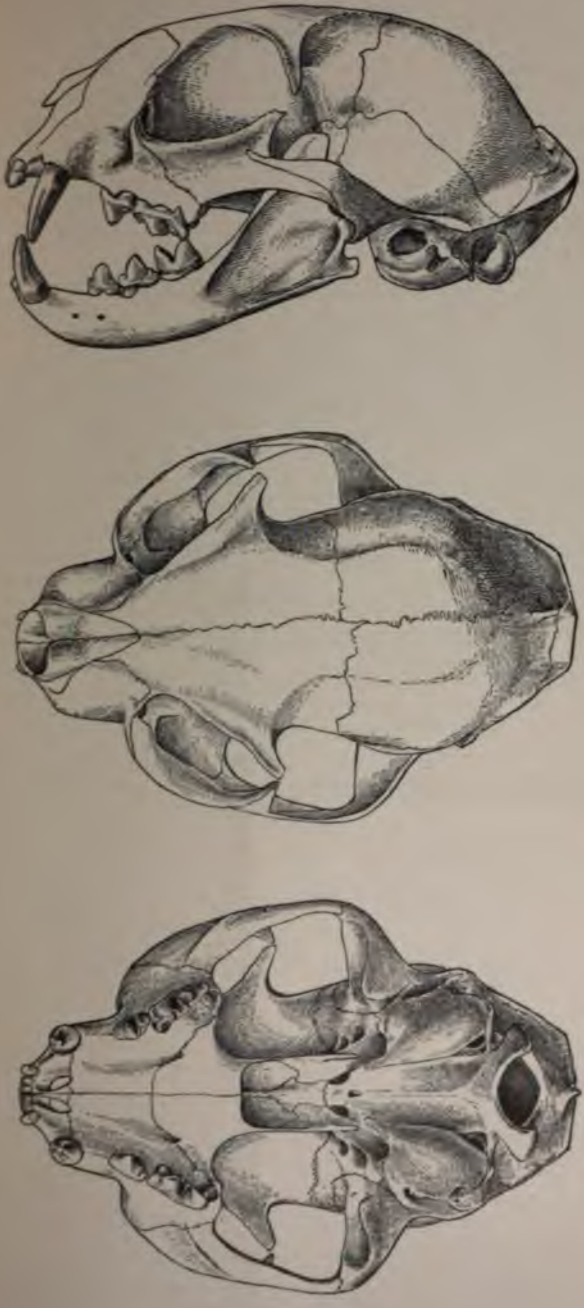
1-4. *Mephitis estor* sp. nov.

5-8. *Neotoma mexicana.*

PLATE XI.

Lynx baileyi Merriam (No. [illegible]), ♀ ad. San Francisco Mountain, Arizona.
thirds natural size.)



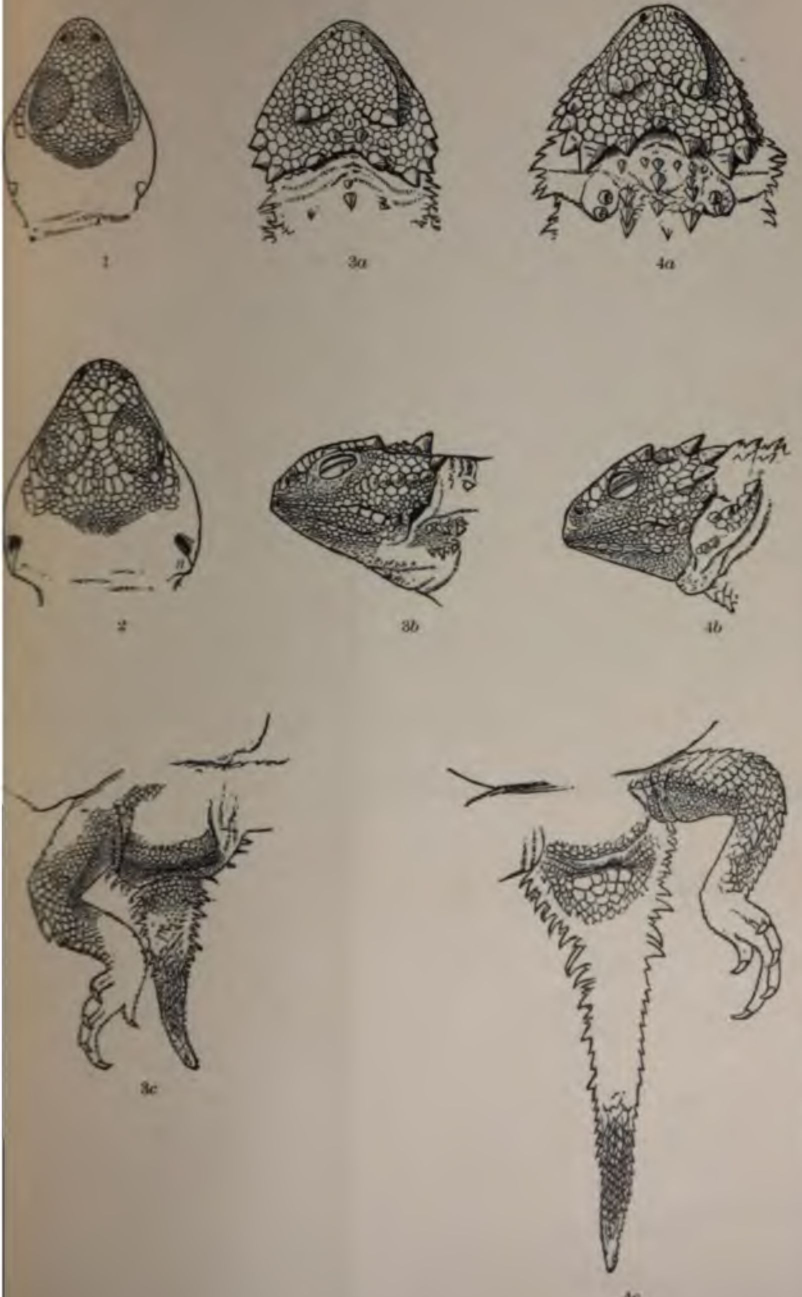
Lynx baileyi sp. nov., ♀, old ([illegible] nat. size).

PLATE XII.

(All natural size.)

1. (15821) *Crotaphytus baileyi* Stejn. *Type.* Little Colorado Desert, Arizona.
2. (9368) *Crotaphytus collaris* (Say). Verdigris River, Arkansas.
3. (15818) ***Phrynosoma ornatissimum*** **(Gir.). Little Colorado Desert, Arizona.**
4. (15802) ***Phrynosoma hernandesi*** **(Gir.). San Francisco Mountain, Arizona.**

PLATE XII.



1 3*a* 4*a*

2 3*b* 4*b*

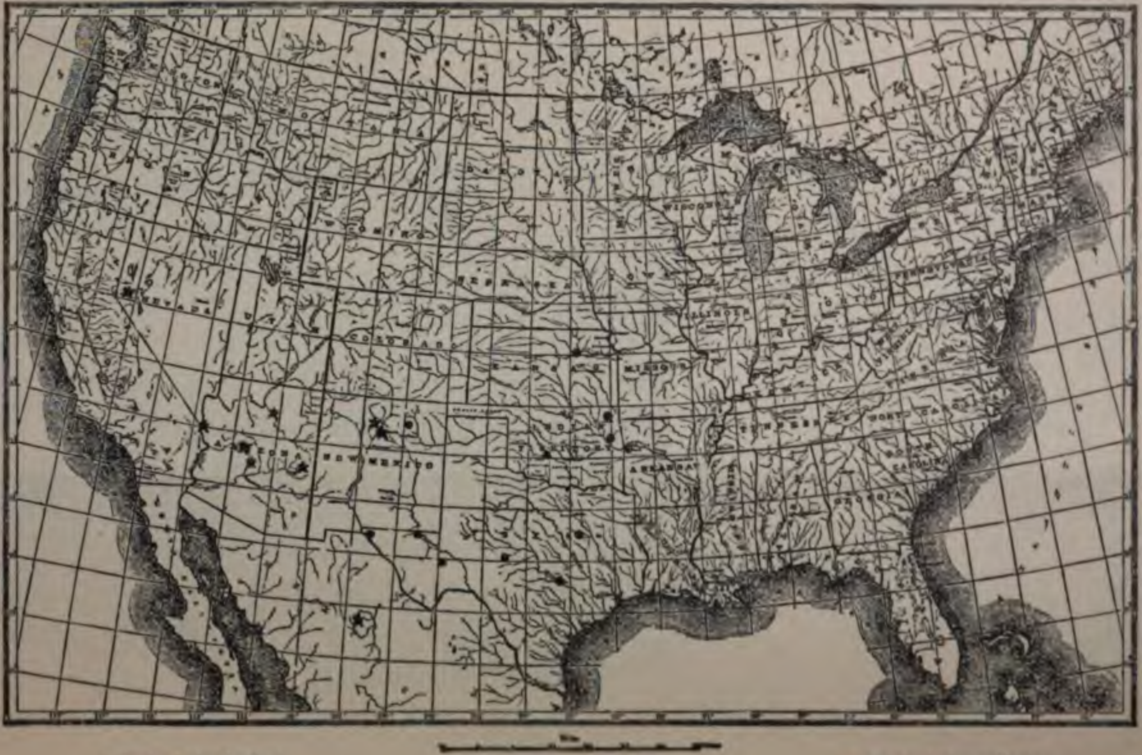
3*c* 4*c*

Crotaphytus baileyi. 2. *C. collaris.* 3. *Phrynosoma ornatissimum.* 4. *P. hernandesi.*

PLATE XIII.

f the United States showing localities from which specimens of *Crotaphytus*
nd *C. collaris* have been examined.

PLATE XIII.

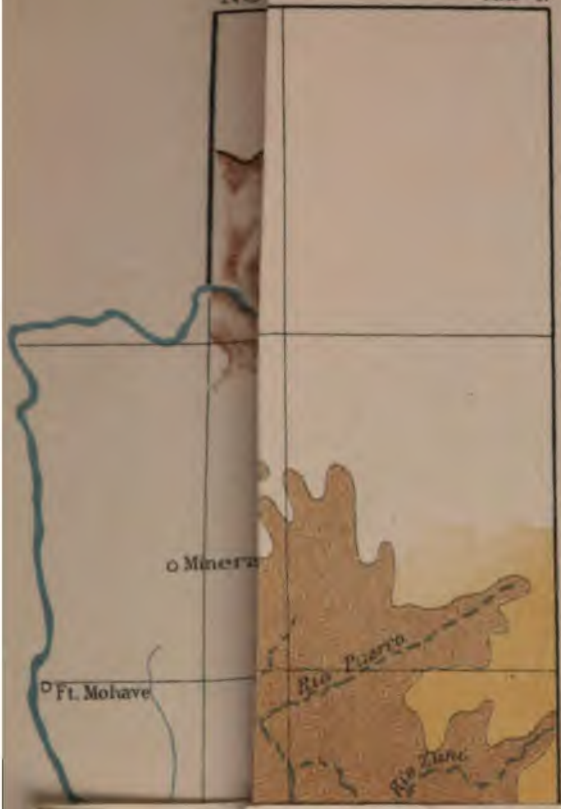


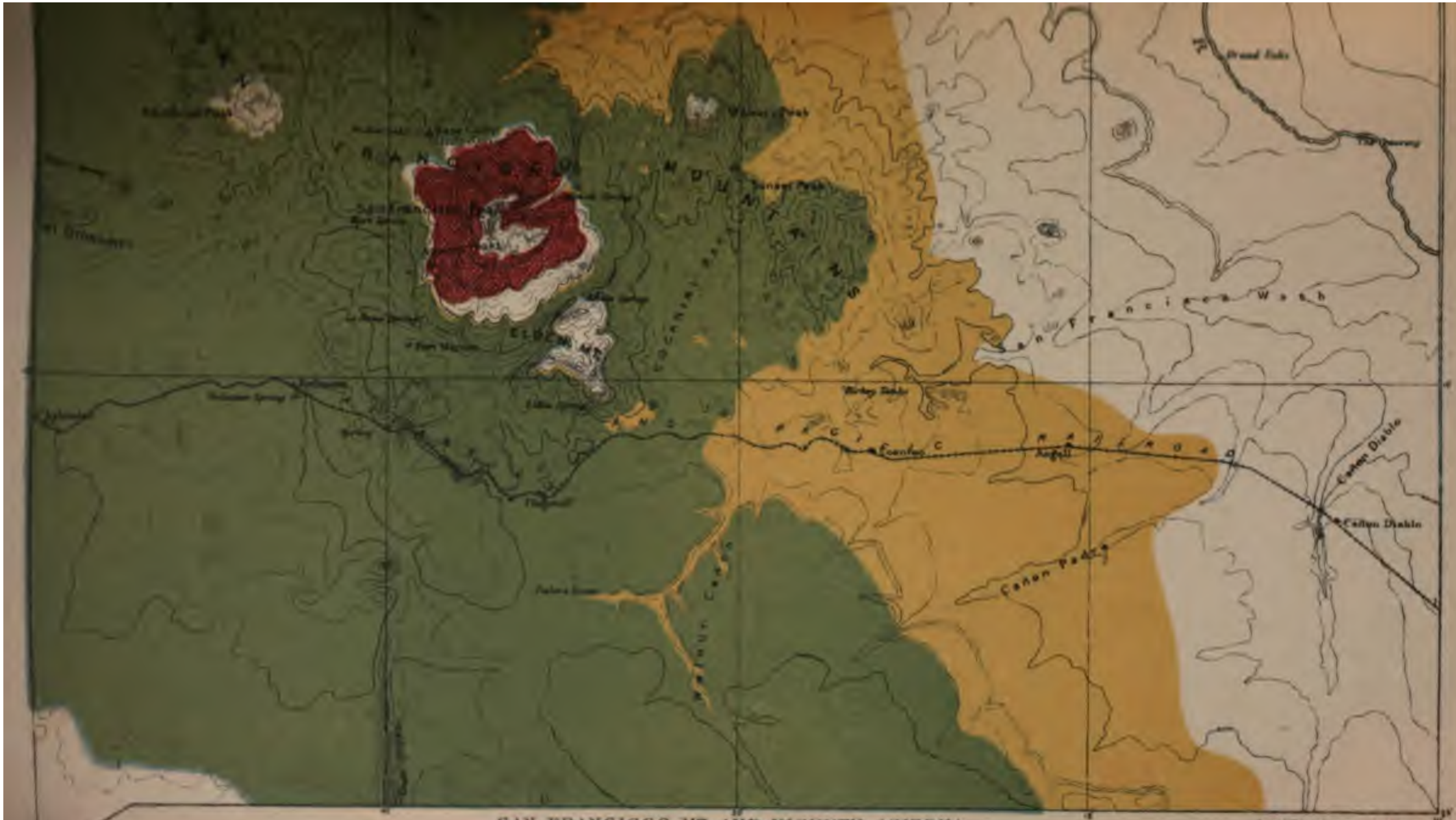
✱ Crotaphytus baileyi.

● Crotaphytus collaris.

NO

MAP I.





SAN FRANCISCO MT. AND VICINITY, ARIZONA.

Contour Interval 250 feet.

MAP 5.

PROVISIONAL BIOLOGICAL MAP OF NORTH AMERICA, SHOWING PRINCIPAL LIFE AREAS. (PREPARED IN JANUARY, 1890.)

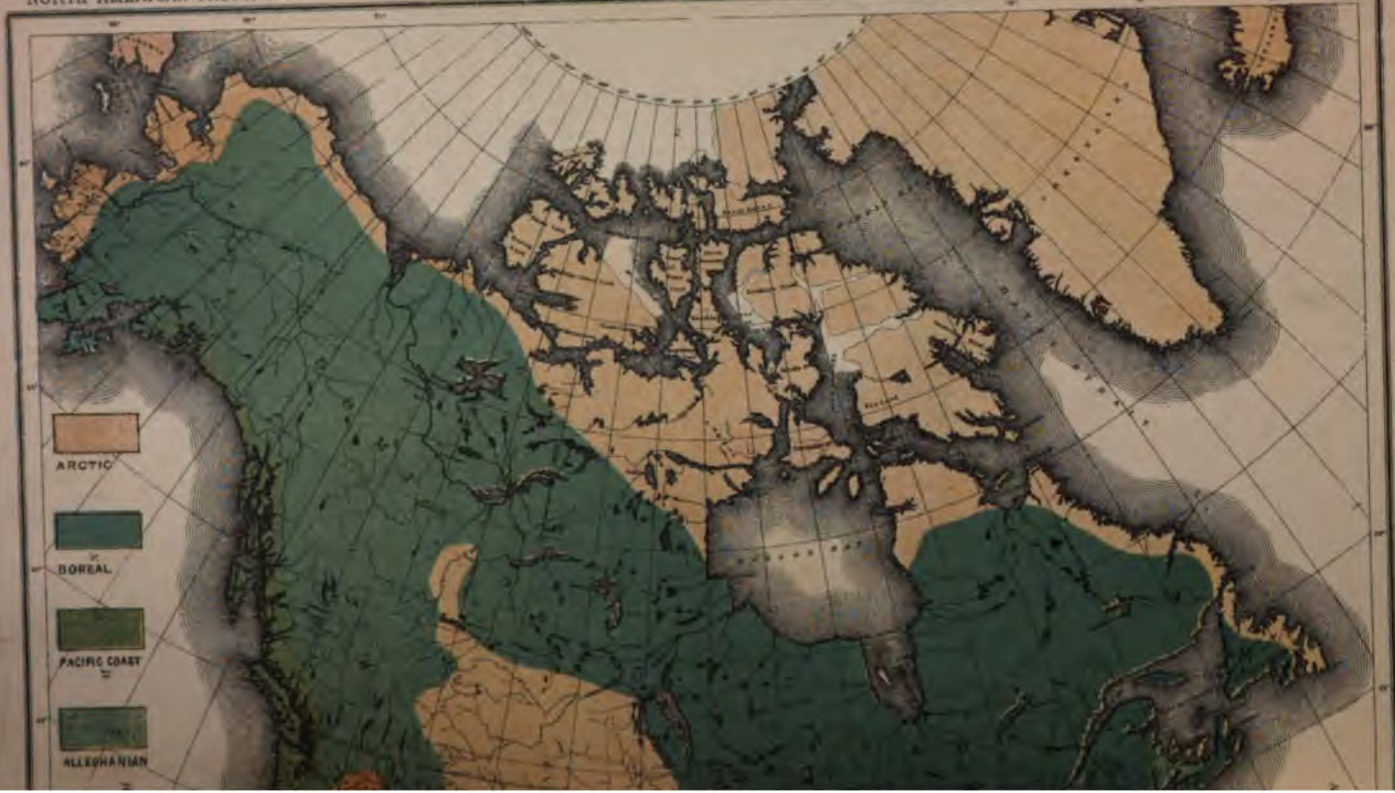
[See Pages 24-26.]

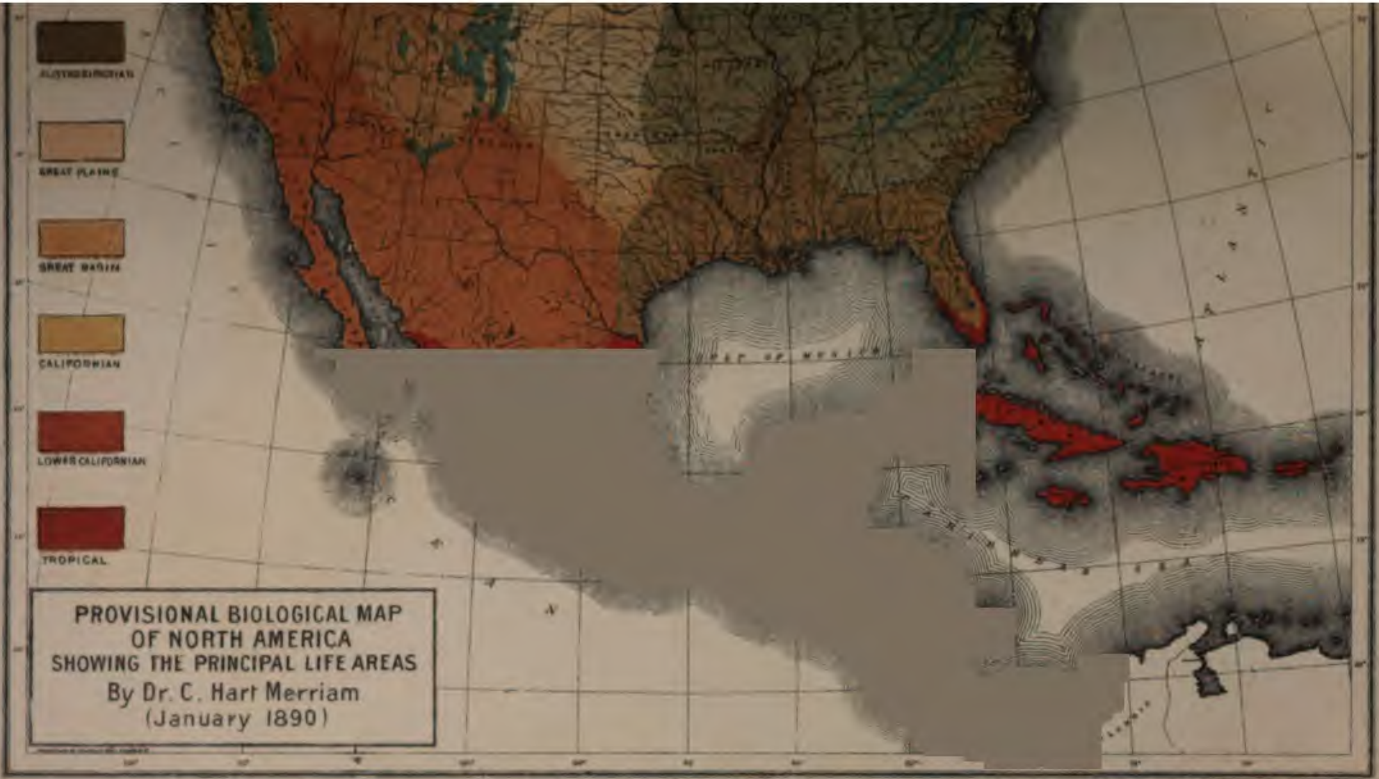
The areas indicated in different colors are not of equal value. The Boreal Province, as shown on the map in one color (green), is the equivalent of the Sonoran Province, which is shown in six colors, one for each of its principal divisions, as follows: The Sonoran proper, the Austroriparian, the Great Plains, the Great Basin, the Californian, and the Lower Californian. The Boreal Province comprises three zones—Subalpine or timber-line, Hudsonian, and Canadian—each of which undergoes certain changes in passing from the Atlantic to the Pacific, but our knowledge of the region is too vague to justify an attempt to show the resulting divisions.

The Carolinian Fauna is a northward extension of the Austroriparian, while the Alleghanian is neutral ground between the latter and the southernmost division of the Boreal Province (the Canadian Fauna). The data thus far accumulated do not admit of tracing the boundaries of these minor subdivisions or their equivalents in the West.

NORTH AMERICAN FAUNA No 3.

MAP 5.





PROVISIONAL BIOLOGICAL MAP
OF NORTH AMERICA
SHOWING THE PRINCIPAL LIFE AREAS
By Dr. C. Hart Merriam
(January 1890)

S. DEPARTMENT OF AGRICULTURE

DIVISION OF ORNITHOLOGY AND MAMMALOGY

J O Snyder

NORTH AMERICAN FAUNA

No. 4

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

[Actual date of publication, October 8, 1890]

Descriptions of twenty-six new species of North American Mammals

BY DR. C. HART MERRIAM

WASHINGTON
GOVERNMENT PRINTING OFFICE
1890

MEASUREMENTS.

All measurements of specimens are in millimeters.

All MAMMALS collected by Field Agents of the Division are measured in accor
with the following instructions:

(1) The TOTAL LENGTH is the distance between the tip of the nose and the
the tail vertebræ. It is taken by laying the animal on a board, with its nose a
a pin or upright post, and by straightening the back and tail by extending th
legs with one hand while holding the head with the other; a pin is then drive
the board at the end of the vertebræ.

(2) THE LENGTH OF TAIL is the length of the caudal vertebræ. It is tak
erecting the tail at a right angle to the back, and placing one point of the divid
the backbone at the very root of the tail, the other at the tip end of the verteb

(3) The HIND FOOT is measured by placing one point of the dividers again
end of the heel (*calcaneum*), the other at the tip of the longest claw, the foot
flattened for this purpose.

In measuring the hind foot in dry skins, the foot is first wrapped in wet abs
cotton until the toes can be straightened.

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

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BY DR. C. HART MERRIAM

WASHINGTON
GOVERNMENT PRINTING OFFICE
1890

U. S. DEPARTMENT OF AGRICULTURE,
August 12, 1890.

SIR: I have the honor to transmit herewith No. 4 of NORTH AMERICAN FAUNA. It contains descriptions of twenty-six new species of North American mammals, nearly all of which were discovered in the course of the biological explorations conducted by the Division.

Respectfully,

C. HART MERRIAM,
Chief of Division of
Ornithology and Mammalogy.

Hon. J. M. RUSK,
Secretary of Agriculture.

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No. 4. NORTH AMERICAN FAUNA. October, 1890.

CONTRIBUTION TOWARD A REVISION OF THE LITTLE STRIPED SKUNKS OF THE GENUS SPILOGALE.

WITH DESCRIPTIONS OF SEVEN NEW SPECIES.

By Dr. C. HART MERRIAM.

The number of specimens of *Spilogale* at present available for study and comparison is wholly insufficient to warrant a final attempt to establish and define the North American species and subspecies; at the same time it is ample to demonstrate the absurdity of 'lumping,' under one specific name, as is now the practice, all the forms inhabiting the United States, from Florida to California.

The present paper is based on the study of 39 skins and 38 skulls, derived from the following sources: U. S. National Museum, 8 skins and 9 skulls; Department of Agriculture series, 12 skins and 11 skulls; Merriam collection, 19 skins and 18 skulls.

The examination of this material shows that the members of the genus may be readily separated into two divisions, according to the general shape of the skull; one having the cranium broad and flat, with the fronto-parietal region depressed, presenting the extreme of differentiation of the genus; the other with the cranium narrower and more highly arched and the fronto-parietal region somewhat elevated, approaching the normal *Mephitine* type. The members of the latter division inhabit the Gulf States and Mississippi Valley, extending as far westward (at least) as Trego County, Kans.; the members of the former inhabit the Sonoran region of the west, from central Texas westward through New Mexico and Arizona to California, extending south to ape St. Lucas and north to British Columbia and the Great Basin.

The eastern group, so far as represented in the meager series at hand, mprises three species, one inhabiting Florida, one Alabama, and one nsas. How far the limits of dispersion of each form extend, and ther or not any of them intergrade, are questions that can not be settled until specimens from intermediate localities are examine Florida form is the smallest and whitest; the Kansas form is the and blackest.

The western group comprises at least three species and two subspecies, but, considering the great extent of the area it inha even less fully represented in available specimens than the One species inhabits south-central (and western ?) Texas; one and southern California; and one the southern part of the penin Lower California.

In the genus *Spilogale*, as in the allied genera *Mephitis* and *Co* the range of individual variation is considerable, though by no so great as has been assumed. The principal variables are four, (1) cranial characters; (2) dental characters; (3) length of tail; (markings. As a rule the variation in each species is between limits which may be defined.

The males are much larger than the females and have consi longer tails.

Color and markings.—The color markings are constant in throughout the genus, the only variation being in the quantity o the widest extremes being the result of the extension or suppres some of the markings. In the young the ground color is intensel and the markings are pure white. As age advances, the marki come creamy yellow, and in worn states of the pelage and old n specimens the black becomes dull brown.

General remarks on cranial characters and variation.—As stated, there are two well-marked groups in the genus *Spiloga* having the cranium broad and flat, with the fronto-parietal re pressed to the general plane of the top of the skull; the other the cranium relatively narrow and more highly arched, with the parietal region somewhat elevated. (See figs. 1 and 2.)

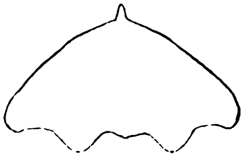

FIG. 1.—Transverse section of skull of *Spilogale gracilis*.

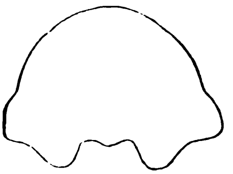

FIG. 2.—Transverse section of skull o *ringens*.

The angle of divergence of the lateral series of teeth is greate narrow than in the broad skulls. As a rule, the postpalatal reaches the plane of the molars in the narrow-skulled forms, a short of this plane in the others. As a rule, also, in the narrow forms, the first and second upper premolars are not crowded, overlap, and are wholly in the tooth-row, while in the broad forms they are much crowded and partly overlap, or the first is *obliquely* or sideways to give the succeeding tooth more room.

The degree of inflation of the mastoids varies greatly in the species of both groups, and is not always proportional to the intermastoid breadth of the cranium. Thus, in the type of *S. lucasana*, in which the inflation is only moderate, the ratio of mastoid breadth to basilar length of Hensel is 69.3, while in *S. leucoparia*, which presents the maximum of inflation, the ratio is only 66.8. In some species the inflated mastoid is set off from the upper surface of the cranium by a distinct change of direction in the bone, or even by a well-marked groove or sulcus, while in others no such line of demarkation exists. The upper part of the inflated mastoid is covered by the squamosal, the outer edge of which, in the broad-skulled species, usually forms a sharp ridge along the outer side of the mastoid capsule. In *S. leucoparia*, however, this ridge is obsolete. The two species having the largest (most inflated) capsules are *S. leucoparia* of central Texas, and *S. putorius* of Florida. The degree of inflation varies somewhat with age, being greatest in young adults or middle-aged individuals and least in those of advanced age.

The postmolar production of the palate varies somewhat with age and sex. Thus, in two adult skulls from Provo, Utah, the postpalatal notch reaches the plane of the molars in the female, but not in the male. As a rule, it reaches the plane of the molars in the narrow-skulled forms, and falls short of this plane in the broad skulls.

The horizontal ramus of the jaw is nearly straight in all the flat-skulled forms except *lucasana*; it is strongly convex below in *lucasana* and in all the narrow-skulled forms.

The size, shape, and proportions of the sectorial teeth and of the upper molar afford excellent specific characters. The postorbital part of the frontal narrows with age. In the adults of some species there is a marked postorbital constriction, while in others no trace of it exists. The value of this excellent character is often destroyed by large asymmetrical postorbital swellings resulting from the presence, in the frontal sinuses, of a worm-like endoparasitic arachnid of the genus *Pentastoma*. Some species have distinct, peg-like postorbital processes, which in others are represented merely by slight protuberances.

Young skulls, compared with adults of the same species, are more highly arched, the brain case is more inflated, and the zygomatic arches are less spreading. The sectorial teeth and molars are sometimes actually larger than in old specimens, for the reason that the teeth complete their growth very early, and in old age become smaller by the wearing away of the crowns.

The bones of the skull unite very early, as usual in the *Mustelidæ*, all the sutures disappearing during the first few months.

Cranial and dental measurements and ratios.—The time has not yet arrived for fixing the limits of individual variation in any group of the *Mammalia*. When a series of a hundred or more skulls of a single species from a single locality, of the same sex and approximately the same age, shall have been carefully measured and the ratios of these measurements toward the attainment of a knowledge of the Little Striped Sk contains a table of the cranial and dental measurements and rat most of the adult (and a few immature) skulls to which I have ha cess. Many of the measurements, and more of the ratios, are wortl and the table is published as much to show these as those whic really important.

In comparing one species with another, adult skulls only shou selected and they should always be of the same sex.

The value of measurements and ratios of the postorbital constr is frequently destroyed, as previously stated, by the large swelling duced by the worm-like parasite (*Pentastoma* or *Linguatula*) whi fests the frontal sinuses of more than half of the skulls exam Thus, the constriction in an old male, *S. gracilis* (No. 5852), fro George, Utah, is entirely obliterated, notwithstanding the fact t *gracilis* has the deepest constriction of any of the known species. same extreme of distortion occurs in an old female from Roseburg gon (No. 24200).

Other skulls in which the postorbital breadth is more or less af by these swellings are Nos. (U. S. National Museum) 4143, 4219, 3 and perhaps also 24115, 24116, and 24117, and (Merriam colle 1800, 2100, 2270, 2408, 2583, 3985, 4266, 5676, 6314, 6315, 6328.

In a few very old skulls the upper molars are worn down so fa their measurements and ratios are unreliable. This is the case in (U. S. National Museum) 1622, 4143, 24200, 24897 and (Merriam c tion) 3985 and 5852; and Nos. 5676 and 6315 are somewhat worn.

Generic characters of Spilogale contrasted with Mephitis.—The many-striped skunks were separated from their larger single or d

Spilogale is a perfectly valid genus, and may be known from *Mephitis* by the following cranial and dental characters.

The cranium as a whole is flat and broad, the frontal and parietal regions being so depressed that the top of the skull presents a nearly straight plane, instead of being highly arched as in *Mephitis*; the skull is broadly wedge-shaped in outline; the mastoids are greatly inflated, forming elliptical capsules which reach on either side from the meatus to the exoccipital, the outer border of which is pushed backward toward the condyle; the paroccipital process is obsolete or rudimentary; the tube of the auditory meatus is bent strongly forward; the supraorbital processes are more strongly developed; the step of the mandible is absent; the first lower premolar is relatively much larger; the upper sectorial tooth is longer; the upper molar is narrower antero-posteriorly; and the zygomatic arches are more spreading and are broadest and highest in the middle instead of posteriorly.

Geographic distribution.—At the time when Baird wrote his great work on the mammals of North America, the Little Striped Skunks were known from California and Texas only. I have examined specimens from North Carolina, Georgia, Florida, Alabama, Mississippi, Kansas, Texas, Arizona, Lower California, California, Oregon, Washington, Utah, and Idaho, and species of the genus are known to inhabit Iowa and Wyoming.

Faunal position.—The genus *Spilogale* is a Sonoran genus, coming into the United States from Mexico, and ranging northward and eastward as far as the ramifications of the Sonoran fauna extend. To the south it reaches Yucatan and Guatemala (Alston, in Biologia Centrali-Americana).

The only part of the United States in which *Spilogale* oversteps the bounds of the Sonoran fauna is along the west coast, where, as previously explained (North American Fauna, No. 3, p. 26), the Sonoran and Boreal elements are curiously mixed.

Synonymy and nomenclature.—The synonymy and nomenclature of the Little Striped Skunks is somewhat involved. Without going fully into the history of the subject, it may be stated that four specific names have been applied to North American animals which are now recognized as belonging to the genus *Spilogale*, namely, *putorius* (Linnæus, 1758); *interrupta* (Rafinesque, 1820); *bicolor* (Gray, 1837); *quaterlinearis* (Winans, 1859).

The name *Viverra putorius* was given by Linnæus in 1758 to the Little Striped Skunk of Florida or Carolina, and was based primarily on Catesby's description and figure. It becomes available therefore for the Florida animal, to which it is here restricted.

The name *Mephitis interrupta* was given by Rafinesque in 1820 to the species inhabiting 'Louisiana,' but Louisiana at that date was commonly spoken of as stretching far to the northwest, including most of the territory west of the Mississippi River and east of the Rocky Mountains.

The name was afterward (1836) restricted by Lichtenstein to the black-tailed form of the 'Upper Missouri River.'

The name *Mephitis bicolor* was given by Gray in 1837 to a North American animal; but since the locality was not mentioned, and the description contains nothing distinctive, it is impossible to ascertain which form he had in mind, and the name must be dropped. Indeed, Gray himself, in 1865, gave it as a synonym of *M. interrupta* of Rafinesque.

The name *Mephitis quaterlinearis* was given by one Winans, in 1859, t
the Kansas animal,* and like the foregoing becomes a synonym o
interrupta.

The name *Viverra zorrilla* was given by Schreber, in 1778, to a Sout
American species, and consequently may be dismissed from further con
sideration in the present connection.

Hence but two specific names are available for species inhabiting th
United States, namely, *putorius* for the Florida animal, and *interrupt*
for the animal inhabiting the Missouri region, of which Kansas speci
mens may be regarded as typical.

KEY TO SPECIES AND SUBSPECIES OF SPILOGALE.

A.—CRANIUM BROAD AND FLAT; FRONTO-PARIETAL REGION DEPRESSED TO GENERAL LEVEL OF UPPER SURFACE OF SKULL.

*a*¹. Under jaw strongly convex below .... *lucasan*
*a*². Under jaw straight or nearly straight below.
  *b*¹. Mastoids enormously inflated and evenly rounded below, with hardly a tra
    of lateral ridge .... *leucopar*
  *b*². Mastoids moderately inflated, not evenly rounded below, with lateral rid
    well developed.
    *c*¹. Postorbital processes but little developed; interorbital constrictio
      marked .... *gracil*
    *c*². Postorbital processes strongly developed; interorbital constriction faint
      absent.
      *d*¹. Combined length of crowns of upper sectorial tooth and molar equa
        length of pterygoid fossa from base of hamular .... *phena*
      *d*². Combined length of crowns of upper sectorial tooth and molar falls co
        siderably short of length of pterygoid fossa .... *saxatil*

B.—CRANIUM NARROWER AND MORE HIGHLY ARCHED; FRONTO-PARIETAL REGIO SOMEWHAT ELEVATED.

*a*¹. Combined length of upper sectorial tooth and molar greater than length
    mastoid capsule, and equal to distance from anterior lip of foramen ma
    num to foramen lacerum medium .... *indianol*
*a*². Combined length of upper sectorial tooth and molar less than length of masto
    capsule, and much less than distance from anterior lip of foramen ma
    num to foramen lacerum medium.
  *b*¹. Inner lobe of upper molar broadly rounded on inner side, with greatest co
    vexity near middle.
    *c*¹. Distance from nasal emargination to point midway between postorbit
      processes at least one-third the length of the top of skull...... *interrup*

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* See Coues, Fur-Bearing Animals, 1877, 233-240.

c^2. Distance from nasal emargination to point midway between postorbital processes considerable less than one-third the length of the top of the skull...*ringens*.

b^2. Inner lobe of upper molar not broadly rounded on inner side, and with decided projection considerably behind middle of tooth...............*putorius*.

SPILOGALE PUTORIUS Linnæus.

Viverra putorius.—Linnæus, Systema Naturæ, ed. x, i, 1758, 44 (based primarily on the *Putorius americanus striatus* of Catesby).

General characters.—The Little Striped Skunk of Florida is conspicuous for its small size, short tail, and the extent of the white markings. In addition to the usual markings, it usually has a white patch or stripe on the outside of the thigh and another on the upper side of the foot, the two rarely being confluent. The rump spots are large and sometimes continuous with the leg-stripe. The stripes at the base of the tail are very large and confluent posteriorly, forming a broad patch of white which covers the upper surface of the basal fourth of the tail. The external lateral stripe is broad, encroaches on the belly, and is continuous posteriorly with the anterior transverse stripe, which, in turn, is often continuous with the internal dorsal stripe. The tail with hairs is much shorter than head and body.

A single specimen from Kissimee Prairie, Florida (No. 4870 ♀ im.), is smaller than the others, and differs from them in the great extent and breadth of the external lateral stripe, which is confluent with both anterior and posterior transverse stripes. The rump spots also are unusually large, and are confluent posteriorly with the tail spots and laterally with the leg-stripe, and the latter is continuous on one side with the foot stripe. The middle pair of dorsal stripes begin posterior to the plane of the ears, leaving the black occipital patch larger than usual.

Cranial characters.—So far as cranial characters go, *S. putorius*, *S. indianola*, *S. ringens*, and *S. interrupta* constitute a closely related group, widely separated from the species inhabiting the arid lands from central Texas westward. They agree in having the cranium relatively high and narrow; the fronto-parietal region somewhat elevated; the upper lateral series of teeth strongly divergent posteriorly; all of the premolars in the tooth row, not overlapping, and rarely crowded; the post-palatal notch ending about on a line with the alveolus of the upper molar and without median projection; a distinct postorbital constriction; and the horizontal ramus of the lower jaw strongly convex below. They further agree with one another, and differ from the flat-skulled forms, except *S. leucoparia*, in lacking a distinct crest or ridge along the outside of the mastoid capsule (formed by the edge of the squamosal). *S. putorius* and *S. indianola* have the smallest and shortest skulls. *S. putorius* has the largest mastoid capsules, and differs from all the others n the shape of the inner lobe of the upper molar, the postero-internal crescent of which projects strongly toward the median line posterior to the middle of the tooth. In *S. interrupta*, *indianola*, and *ringens* the inner lobe of the upper molar is broadly and evenly rounded, bringing the most prominent part of the convexity nearly opposite the middle of the tooth instead of considerably behind it. The nasal opening is constricted laterally in its upper half.

In *S. putorius*, *interrupta*, and *indianola*, the length of the upper surface of the rostrum, from the nasal emargination to the plane of the postorbital processes, is just half the length of the upper surface of the cranium behind the postorbital processes, while in *S. ringens* the latter measurement is considerably more than double the former.

Measurements.—A fully adult male, captured at Lake Worth, Fla., May 20, 1889, by Morris M. Green (U. S. National Museum, No. $\frac{17134}{24117}$), afforded the following measurements in the flesh: Total length, 372; tail vertebræ, 129; hairs, 50; hind foot, 39. A female caught at the same place two days previously (U. S. National Museum, No. $\frac{17133}{24115}$) measured: Total length, 340; tail vertebræ, 117: hairs, 48; hind foot, 37.

SPILOGALE INTERRUPTA Rafinesque.

Mephitis interrupta.—Rafinesque, Annals of Nature, I, 1820, 3. Lichtenstein, Abhand. Akad. Wiss., Berlin (for 1836), 1838; 281, tab. II, fig. 1.

Mephitis quaterlinearis.—Winans [Kansas?], newspaper, 1859 (see Coues, Fur-Bearing Animals, 1877, 239–240).

General characters.—This species may be known from all others by the large size of the tail and the limited extent of the white markings. The tail, with hairs, is longer than the head and body, and is large and full. As a rule it is black throughout; and the white when present, is limited to a slender tuft surrounded by the black hairs of the extreme tip. The head markings are very small, the frontal spot being less than half the usual size, and the crescent in front of the ear being reduced to an inconspicuous streak or dab wholly unconnected with the lateral stripe, there being no white at all under the ear. All of the white stripes are reduced in size, so that the animal has the blackest back of any known species, *S. ringens* approaching it most closely in this respect.

Cranial characters.—The skull of *S. interrupta* is longer and higher posteriorly than that of *S. putorius*, and the audital bullæ are much less inflated. The inner lobe of the upper molar is broadly rounded, with the most prominent part of the convexity opposite the middle of the tooth, instead of far behind the middle as in *S. putorius*. The postorbital processes are feebly developed and there is scarcely a trace of postorbital constriction.

Specimens of *Spilogale interrupta* have been examined from various places in Kansas, from the eastern part of the state (Barber and Coffey Counties) west to Trego County, and from the Kiowa Indian Agency, *General remarks.*—Whatever doubt may arise as to whether or not he species here described is really the *Mephitis interrupta* of Rafinesque, there can be none whatever that it is the *M. interrupta* of Lichenstein; so that the question, if any, relates not to the name of the pecies but merely to the authority for the name. Lichtenstein distinctly states that his animal came from the 'Upper Missouri' and that it had a black tail.

Measurements.—The average measurements of four males from Trego County, Kans., are as follows: Head and body,* 350; tail vertebræ, 216; hairs, 105; hind foot, 49.5. The average measurements of two females from the same locality are: Head and body, 320; tail vertebræ, 208; hairs, 80; hind foot, 43.5.

SPILOGALE RINGENS sp. nov.

Type No. $\frac{23183}{30042}$ ♀. U. S. National Museum (Department of Agriculture collection). Greensborough, Hale County, Alabama, August 2, 1890. Collected by C. S. Brimley. (Original number, 50.)

Measurements (taken in flesh).—Total length, 460; tail vertebræ, 165; hind foot, 45; pencil, 88.

General characters.—Size considerably larger than *S. putorius*; about equaling *S. interrupta*, with which it is most closely related; tail with hairs longer than head and body, white markings restricted; no white on legs or feet; frontal spot very small; crescent in front of ear not continuous or barely continuous with lateral stripe; white of tail limited to terminal third above and terminal half below; while the white is less extensive than in *S. putorius*, it is more extensive than in *S. interrupta.*

Cranial characters.—Compared with *S. interrupta*, its nearest relative, the skull of *S. ringens* is broader across the postorbital processes and interorbitally, has better developed postorbital processes, and a decided postorbital constriction. The distance from the nasal emargination to the plane of the postorbital processes is considerably less than one-third the length of the top of the skull, while in *S. interrupta* it is just one-third. The ratio of the distance across upper molars to the upper lateral series of teeth is about 120 in *ringens* and 113 in *interrupta.*

Compared with *S. putorius* the skull is longer, the brain case is higher posteriorly, the inflated mastoids do not project so far laterally, the inner lobe of the upper sectorial tooth is larger and broader, and the inner lobe of the upper molar is evenly rounded off, the most prominent part of the convexity being near, instead of behind, the middle of the tooth.

While the type is from Hale County, Ala., other specimens have been examined from Cherokee, N. C., Corinth, Miss., and Mobile, Ala.

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* Unfortunately, the collector did not record the total length in the flesh; but by ding the length of the tail to the head and body, an approximate measurement may e obtained.

The latter has a little more white than the others, and the ante-auricular crescent is narrowly continuous with the lateral stripe. In the Corinth specimen the white tip of the tail reaches further down than on the others.

SPILOGALE INDIANOLA sp. nov.

Type (skull) No. 1621, young adult. U. S. National Museum. From Indianola, Matagorda Bay, Texas. Collected by J. H. Clarke, in 1851.

This species is founded on two skulls collected at Indianola, Matagorda Bay, Texas, by J. H. Clarke, of the Mexican Boundary Survey. The skins were not preserved, and nothing whatever is known of the external characters of the animal. It probably is a Mexican tropical species extending north along the Gulf coast of Texas.

Cranial characters.—The skull is small, and the brain case is short and highly arched, as in *S. putorius* from Florida. It differs from *putorius*, however, in being narrower across the postorbital processes, in having smaller and less prominent mastoid capsules, smaller audital bullæ, longer pterygoid fossa, and larger teeth. The upper sectorial and molar particularly are much larger than in *putorius*, the combined length of the two teeth exceeding the length of the mastoid capsule and equaling the distance from the anterior lip of the foramen magnum to the foramen lacerum medium, in these respects differing from all known species of the genus. The inner lobe of the upper molar is very large and broad, and is broadly and evenly rounded off on the inner side, the greatest convexity being opposite the middle of the tooth instead of considerably behind it. The ratio of breadth to length of the upper molar is 126, while in *S. putorius* it is 136.

The lower sectorial tooth is very much larger, and the last lower molar about double the size of the same tooth in *S. putorius*.

Average ratios of several specimens each of Spilogale indianola, S. interrupta, S. ringens and S. putorius.

	S. indianola.	S. interrupta.	S. ringens.	S. putorius.
Ratios to basilar length of Hensel:				
Length of upper lateral series of teeth	37.5	36	35.5	35
Length of upper sectorial and molar together	23.6	22.1	20.8	21.
Length of upper sectorial	14.3	13.2	12.5	13
Length of pterygoid fossa	25	24	23.8	24
Ratio of mastoid breadth to palatal length	143	150.5	156	162
Ratio of breadth to length of upper molar	126	132	134	136

SPILOGALE LUCASANA sp. nov.

Type No. $\frac{[illegible]}{4219}$ ad. U. S. National Museum. From Cape St. Lucas, Lower California. Collected by John Xantus. (Original number. 603.)

General characters.—Size large; tail long (with hairs apparently about as long as head and body); terminal pencil white; white markings large and broad. Median pair of dorsal stripes broadly confluent posteriorly with anterior transverse bands, and thence with external lateral stripes; lumbar spots on each side elongating posteriorly so as to form a distinct stripe, which becomes confluent with the posterior transverse stripe of the same side, forming an acute angle posteriorly at point of union; tail spots indistinctly confluent posteriorly. Two parallel longitudinal white stripes extend back from the chin to the throat, where they are connected by a transverse curved line. Two other white stripes, one on each side, reach backward from the angles of the mouth to a point a little below and posterior to the ears, where they indistinctly join the lateral stripes. This is the only species known to me in which there is any regularity in the throat and chin markings.

Cranial characters.—Two skulls from Cape St. Lucas, Lower California (the type, No. 4219, and No. 4143, U. S. National Museum), are much larger, broader posteriorly, flatter, and everywhere more massive than those of any other species examined. The postorbital processes are well developed; the postorbital constriction is not noticeable; there is a distinct sagittal crest; the post-palatal notches fall considerably short of the plane of the alveoli of the upper molars; the upper molars are rectangular, with a deep notch behind, and the postero-internal angle projects furthest toward the median line as in *S. putorius* from Florida; there is no line of demarkation on the upper surface of the skull between the inflated mastoids and cranial parietes.

The first upper premolar is small. In one skull (No. 4143) it is absent on one side and very small on the other, but is wholly in the tooth row. In the other skull (the type, No. 4219) it is present on both sides, larger, and slightly overlaps the canine. The second upper premolar is not crowded and does not overlap the third.

The under jaw is more convex below than in any other species known to me; the angular process is set up higher, and there is more evidence of the 'step' which is so characteristic of *Mephitis*.

SPILOGALE LEUCOPARIA sp. nov.

(Plate I, figs. 4-6.)

Type No. $\frac{1301}{2370}$ ♂ ad. Merriam collection. From Mason, Mason County, Texas, December 2, 1885. Collected by Ira B. Henry. (Original number, 16.)

General characters.—Size medium (total length of ♂, about 400; hind foot, about 45), tail with hairs shorter than head and body. White markings larger than in any other known species, the white on back equaling or even exceeding the black in area; all the stripes are broader than in the other species; the middle pair of dorsal stripes are continuous posteriorly with the anterior transverse stripe, which in turn are broadly confluent with the external lateral stripes. The lumbar spots are generally confluent with the posterior transverse stripes. The tail spots are sometimes confluent posteriorly, forming a narrow band across the base of the tail. There is no white on the thighs, and only rarely a few white hairs on the upper surface of the foot.

Cranial characters.—The skull of *Spilogale leucoparia* presents the maximum degree of inflation of the mastoid capsules yet observed in the genus, surpassing even *S. putorius* of Florida. The inflation is most conspicuous postero-laterally, and in transverse section the capsules are subcircular in outline. The crest or ridge usually formed by the outer edge of the squamosal is obsolete. The audital bullæ are larger than usual.

SPILOGALE GRACILIS Merriam.*

Type No. $\frac{17980}{24897}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Grand Cañon of the Colorado, Arizona (north of San Francisco Mountain), September 12, 1889. Collected by C. Hart Merriam, near bottom of cañon. (Original number, 451.)

Measurements of type (taken in the flesh).—Total length, 400; tail vertebræ, 142;† pencil, 100; hind foot, 46.

General characters.—Size medium: form slender like a ferret; tail with hairs, longer than head and body. External lateral stripe very large and broad, and broadly confluent with the anterior transverse stripe, which in turn is sometimes narrowly confluent with the inner dorsal stripe. Exposed white of tail occupies nearly the whole of the terminal half above and the terminal two-thirds below.

In old individuals the lumbar spots show a tendency to become confluent posteriorly with the posterior transverse stripes. The spots at base of tail are sometimes confluent posteriorly. The males have considerably longer tails than the females.

Cranial characters.—The skull of *S. gracilis* is broad and flat, with the fronto-parietal region depressed to the plane of the top of the skull, and there is a deep postorbital constriction—the deepest possessed by any of the species now known. There are well marked postorbital protuberances, but they are not peg-like processes as in *S. phenax* and *S. saxatilis*.

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* This species has been described in North American Fauna, No. 3, pp. 83–84.

† The tail of this specimen was injured in early life and the terminal portion is absent. In a young individual caught at the cañon two days later, the tail vertebræ measure 160.

SPILOGALE SAXATILIS sp. nov.

Type No. [illegible] ♂ ad. Merriam collection. From Provo, Utah, November 13, 1888. Collected by Vernon Bailey. (Original number, 384.)

Measurements of type (taken in the flesh).—Total length, 450; tail vertebræ, 176; pencil, 100; hind foot, 49. Measurements of ♀ ad. (same locality and date): total length, 400; tail vertebræ, 163; hairs, 80; hind foot, 41.

General characters.—Size, rather large; tail, with hairs, longer than ead and body. External lateral stripe nearly obsolete and barely or ot continuous with anterior transverse stripe. In the type specimen, n adult male, none of the markings are confluent. In an old female taken t the same locality and date, the internal or middle dorsal stripes are arrowly confluent posteriorly with the anterior transverse stripes, and he caudal spots meet indistinctly across the base of the tail. All of the ther spots and markings are distinct. Externally *S. saxatilis* may be disinguished at a glance from its nearest geographical neighbor, *S. gracilis*, y the inconspicuous and nearly obsolete lateral stripe. In *S. gracilis* his stripe is large and broad and broadly confluent with the anterior ransverse stripe.

Cranial characters.—The skull of *S. saxatilis* resembles that of *S. gracilis* in size and proportions, but differs from it in having well-developed postorbital processes, in having the anterior nares deeply and broadly emarginate above, in having the zygomatic arches more broadly and highly arched, and in lacking a deep postorbital constriction (though it has a slight constriction). It differs from *S. phenax* in the shape of the nasal aperture (which is less broadly emarginate above), in the presence of a slight interorbital constriction (altogether absent in *phenax*), in having the last lower molar smaller, and in a number of cranial and dental proportions, which are given in tabular form under *S. phenax.*

SPILOGALE PHENAX sp. nov.

(Plate I, figs. 1–3.)

Type No. [illegible] ♂ ad. Merriam collection. From Nicasio, Marin County, California, October 31, 1885. Collected by C. A. Allen.

General characters.—Size large; hind foot 46 (in dry skin); tail, with hairs, shorter than head and body. External lateral stripes narrow, but considerably broader than in *S. saxatilis;* lumbar spots inclined to become confluent with posterior transverse stripes. Markings otherwise normal. Exposed white portion of tail occupying terminal third above and terminal half below. There is considerable white in irregular patches about the chin and angles of the mouth.

Cranial and dental characters.—The postorbital processes of *S. phenax* each the maximum development observed in the genus; the postorbital constriction is absent; the zygomatic arches are broad and highly arched, and the sectorial and molar teeth are large. The last lower molar is conspicuously larger than in *S. gracilis* and *S. saxatilis.*

S. phenax differs from *S. saxatilis* in the following particulars: The breadth across the postorbital processes is greater (ratio to basilar length 37, against 35.2 in *saxatilis*); there is no attempt at a postorbital constriction; the emargination above the nasal aperture is neither so broad nor so deep; the vault of the cranium is higher; the molariform teeth in both jaws are much larger, particularly the last lower molar, the ratio of which to the interorbital constriction is 20.3, while in *saxatilis* it is 17.4 (the ratio of the interorbital breadth to the basilar length being the same in both skulls); the combined length of the crowns of the upper sectorial tooth and molar equals the length of the pterygoid fossa, while it falls short of it in *saxatilis;* the palate is broader, the ratio of the distance across the upper molars to palatal length being 100.4, while in *saxatilis* it is 94.1); and the inner lobe of the upper molar is narrower (the ratio of the antero-posterior diameter of the inner lobe to the same diameter of the outer lobe being 87.5, while in *saxatilis* it is 95.2).

Several specimens from the region about San Bernardino and Alhambra, in southern California, have longer tails and broader side stripes than the Nicasio specimens, and the markings under the chin tend to arrange themselves in two small parallel stripes, with a small spot at each angle of the mouth. The postorbital processes are smaller than in true *phenax*. This form may merit subspecific separation.

The following table shows the ratios of a number of cranial and dental measurements in *S. saxatilis* and *S. phenax*, and also in *S. gracilis*, their nearest geographical neighbor:

Ratios of type specimens of Spilogale phenax, S. saxatilis, and S. gracilis (all adult males).

	S. phenax, Nicasio, Cal. ♂ ad. No. 2100.	*S. saxatilis,* Provo, Utah. ♂ ad. No. 5675.	*S. gracilis,* Grand Cañon, Arizona. ♂ ad. No. 24897.
Ratios to basilar length of Hensel:			
Height of cranium from posterior margin of palate	28.6	27.2	26.5
Length of upper sectorial tooth	13	12.2	12.5
Length of lower sectorial tooth	16	14.9	15.9
Length of upper sectorial and molar together	21.4	19.7	21.7
Breadth across postorbital processes	37	35.2	35.7
Postorbital constriction	30.4	27	25.9
Ratios to palatal length:			
Distance from foramen magnum to post-palatal notch	141	135	144
Length of upper lateral series of teeth	85.9	82.9	80.5
Breadth across upper molars	100.4	94.1	95.6
Length of upper sectorial tooth	31.4	29.2	31.2
Length of upper molar (antero-posterior diameter of outer cusp)	23.1	20.4	24.4
Ratio of length of last lower molar to interorbital constriction	20.3	17.4	17.7
Ratio of breadth to length of upper sectorial tooth	67.8	66.6	61.4
Ratio of breadth to length of upper molar	145.8	147.6	129.7
Ratio of inner cusp to outer cusp of upper molar (antero-posterior diameter of each)	87.5	95.2	80.8

SPILOGALE PHENAX LATIFRONS subsp. nov.

Type No. [illegible] ♀ old. U. S. National Museum (Department of Agriculture collection). From Roseburg, Douglas County, Oregon, July 13, 1889. Collected by Theodore S. Palmer. (Original number, 216.)

Measurements (taken in the flesh).—Total length, 335; tail vertebræ, 130; pencil, 90; hind foot, 40.

General characters.—Similar to *S. phenax*, but much smaller. No peculiarities in the markings appear in the single specimen examined—a very old, nursing female in worn pelage—except the white under the chin, which is much less extensive than in *S. phenax;* other specimens may have more.

Cranial characters.—The skull of *S. phenax latifrons*, as its name indicates, is broader interorbitally and across the postorbital processes than *S. phenax.* It is broader also across the brain case, the mastoids, and the palate. The last lower molar is much smaller than in *S. phenax.* The skull of the type specimen is so injured that the basilar length can not be taken, but another skull, from Chehalis Co., on the coast of Washington, affords the following ratios, which for convenience of comparison are accompanied by corresponding ratios of the type of *S. phenax:*

	S. latifrons, No. 2583. ♀ yg. ad.	*S. phenax*, No. 2100. ♂ ad.
tios to basilar length of Hensel:		
Interorbital breadth	32.4	29.4
Breadth across postorbital processes	38.9	37
Breadth across molars	43.2	41.6
Breadth across mastoids	65.5	64
Breadth of brain-case	55.1	49

S. lucasana.		a.	S. ringens.			S. interrupta.			
Cape St. Lucas, Lower Cal.		Gi.	Greensborough, Ala.	Mobile, Ala.	Georgia	Trego County, Kans.			
4219.	4143.	2 2. ♂	4266 ♀	30058 ♂	3913.	6314 ♂ im.	6315 ♀	6328 ♀ im.	30060 ♂ im.
64	63		51.7	56	52	52.8	53.5	54.6	58
62	61.5		53.5	54.7	50.7	51.5	52	53.5	57
55.5	55	.8	48	49.2	46	46.5	47.5	48.5	51.5
59	58	.5	48.5	51.5	48.8	47.5	47	47.8	52.7
40.5	40.5	.5	34	34.7	32.5	30.8	31	....	34.8
38.5	37.3	.3	29	30.7	28.5	28.3	28	28.7	31.2
20	19.5		17.7	17.3	18.2	15.6	16	16.4	16.7
18	18.2	.2	15.5	15	14.5	13.7	14	14.4	14.1
15.5	16	.7	13.5	14.7	14.5	14.2	14.3	14.7	15
32.5	32.5	.3	28.5	29.5	27.5	27.5	28.5	29.5	31.4
22.5	22.5	5	19.2	19.4	18	18.5	19	19	20
18	17	5	17.8	18.5	17	17.5	17	17	19
15.8	15.2	.5	14.2	15.2	14.5	14	14.2	14.2	15
24.5	24	.5	23.5	24.5	23	22.8	23.5	23.3	25.2
19.7	18	.5	17	17.5	15.8	16.6	17.3	17.3	18
23.2	22		20.3	21	19	19.3	19.7	19.5	20
15	14.5		11.2	12	10.8	11.2	11.8	11.5	12.3
41.5	41.5	.7	34.6	36.5	33	32.5	33.7	34.5	37
20.5	20.5	.1	16	17.5	16	15.7	16.5	16.2	18.2
12.6	13		11.5	11.8	10.8	11.2	11.7	11.3	12.7
6.9	6.8	.2	6.1	6.3	5.8	6.2	6.4	6	6.5
4.7	4.6	.2	4.2	4.3	3.8	4.2	4.6	4.1	4.3
5.5	5		5.2	5	4.6	5	5	5	5.6
7	7	.3	6.7	6.8	6.3	6.6	6.7	6.6	7.2
6	5.8	3	5	5.3	5	5.5	5.3	5.3	6.2
4.8	4.4	1	4	4.3	3.7	4.1	4.1	4.1	4.7
8.7	8	.4	7.5	7.5	7	7.1	7.7	7.1	7.8
4	4		3.3	3.5	3	3	3.5	3.1	3.5
4	3.5		3	3.2	2.7	2.8	3.3	3.1	3.5
11.5	11.1	.4	10.2	10.1	9.5	10.5	10.8	10.4	11.2
72.9	73.6	.6	70.8	70.5	70.6	66	65.2	....	67.5
69.3	67.8		60.4	62.3	61.9	60.8	58.9	59.1	60.5
44.1	43.6	.3	48.9	49.7	50	49	49.4	48	48.9
40.5	40.9	.2	40	39.4	39.1	39.7	40	39.1	38.8
35.4	32.7	6	35.4	35.5	34.3	35.6	36.4	35.6	34.9
41.8	40	.3	42.3	42.6	41.3	41.5	41.4	40.2	38.8
58.5	59	.7	59.3	59.9	59.7	59.1	60	60.8	60.9
32.4	30.9	.6	37	37.6	36.9	37.6	35.7	35	36.8
28.4	27.6	.8	29.5	30.8	31.5	30.1	29.8	29.2	29.1
12.4	12.3	.1	12.7	12.8	12.6	13.3	13.4	12.3	12.6
15.6	14.5	8	15.6	15.2	15.2	15.2	16.2	14.6	15.1
22.7	23.6	5.1	23.9	23.9	23.4	24	24.6	23.2	24.6
36	35.4	.2	36.8	35.1	39.5	33.5	33.6	33.8	32.4
32.4	33	.1	32.2	30.4	31.5	29.4	29.4	29.6	27.3
27.9	29	.9	28.1	29.8	31.5	30.5	30.1	30.3	29.1
106.3	105.4	.3	101	104.6	106	102.1	98.9	98.5	102.3
20	20.1	.7	21.2	20.5	20.6	22.5	22.7	21.4	21.7
171.1	165.7	2.1	151	158.2	158.3	152.9	147.3	151	156
144.4	144.4	5.7	148.4	152	152.7	148.6	150	155.2	157
87.5	80	.1	88.5	90.2	87.7	89.7	91	91	90
103.1	97.7	2.7	105.7	108.2	105.5	104.3	103.6	102.6	100
30.6	30.2	3.5	31.7	32.4	32.2	33.5	33.6	31.5	32.5
24.4	22.2	7	27	25.7	25.5	27	26.3	26.3	28
65.1	67.6	7.7	68.8	68.2	65.5	67.7	71.8	68.3	66.1
45.9	50	.5	44	46.6	42.8	42.2	45.4	43.6	44.8
87.2	88	2	76.9	86	80.4	82	82	82	83.9
68.5	62.8	5	59.7	63.2	58.7	62.1	61.1	62.1	65.2
127.2	140	6	128.8	136	136.9	132	134	132	128.5
35	37.7	7.5	35.8	36	36.7	37.3	36.9	34.6	36.1
44.1	44.4	4.8	44.1	42.8	44.3	42.7	44.5	41	43.3
117.7	122.2	5.1	119.3	120	120.2	116.2	113.8	112.7	111.1
64.6	65.9	7.8	55.1	57.1	56.8	58	59.8	58.4	61.5
91.6	*86.2*	*4.3*	*104*	94.3	92	90.9	94.3	94.3	90.3

DESCRIPTIONS OF FIVE NEW GROUND SQUIRRELS OF THE GENUS TAMIAS.

By Dr. C. HART MERRIAM.

A. DESCRIPTIONS OF THREE NEW SPECIES OF THE TAMIAS LATERALIS GROUP.

The type specimen of *Tamias lateralis* of Say was collected by Long's Expedition on the Arkansas River in Colorado, a few miles below the present site of Cañon City. Specimens agreeing with the typical form have been examined from other parts of Colorado, from the Uinta Mountains in Utah, and from San Francisco Mountain, Arizona. Comparison of specimens from various parts of the West shows that there are at least three well-marked species which have not yet been described.

The most conspicuous differences by which the several forms may be distinguished are: (1) the extent of the inner black dorsal stripe; (2) the color of the head and neck; and (3) the color of the under side of the tail. In true *lateralis* the under side of the tail (within the submarginal black band) is grizzled *grayish-yellow*. In specimens from the Wahsatch (near Park City, Utah), it is deep, intense *chestnut;* in those from the Sierra Nevada (from Klamath, Oregon, to Lake Tahoe, Nevada, and Donner, California) it is deep *fulvous*. The head and sides of the neck in typical *lateralis* are suffused with ferruginous or *pale* rusty chestnut; in the Wahsatch animal the same parts are *deep* rusty chestnut; while in specimens from the Sierra Nevada they are bright golden-red or ochraceous, strikingly different from any of the others. The inner black stripe is small and more or less obscured in *lateralis;* it is large and distinct in the Wahsatch and Sierra animals, and of medium size in Montana specimens. Specimens from the Medicine Bow Mountains, Wyoming, differ from all the others examined, in having the ground color above very much darker. In some of these specimens the upper surface of the tail is almost black. The form may deserve subspecific recognition.

Seasonal variation in color is more marked in some members of the present group than in any other North American mammal with which I am familiar (excepting, of course, the winter change to pure white in some northern species). This variation relates mainly to the extent and intensity of the red or golden mantle which covers the head and neck. The maximum development of color occurs soon after the close of the breeding season, in August and September; but, as shown by Dr. J. A. Allen* in his recent excellent and highly critical revision of the chipmunks of the *Tamias quadrivittatus* group, the change may be delayed by nursing and other causes, so that specimens showing both extremes may be killed the same day at the same place. As a rule the males are more highly colored than the females. This is particularly marked in *T. cinerascens*, in which the extremes of sexual coloration are so different that it is hard to believe them the same species. Adult males and females of this species, the former in the height of the red, the latter in the purest gray phase, were collected by myself at Helena, Montana, about the middle of August, 1888, together with a few specimens in intermediate pelage.

Common characters.—Tamias lateralis and its allies here described are the largest of the American ground squirrels of the genus *Tamias*. They are intermediate between *Tamias* and *Spermophilus*, and it is open to question whether they do not belong to the latter rather than to the former genus. They certainly depart from *Tamias* proper and agree with *Spermophilus* (section or subgenus *Colobotis*) in the form of the skull, in the general form of the body (in being heavy and thick-set instead of light and slender), in habits, in becoming excessively fat in the fall, and in hibernating early. They differ from all members of both groups in the peculiar pattern of the coloration, namely, the absence of dorsal stripe or stripes, coupled with the possession of three lateral stripes on each side (two of which are black, separated by one which is whitish or yellowish), and a conspicuous mantle of ferruginous-chestnut or ochraceous, which covers the head and neck to the shoulders at least a part of the year. Heretofore but one species (*T. lateralis*) has been recognized. Three additional species are here described. The four may be arranged in couplets according to affinities, thus:

KEY TO SPECIES OF THE TAMIAS LATERALIS GROUP.

a^1. Inner black stripe much smaller than outer; lateral hairs of tail with *two* black bands; under side of tail grizzled yellowish gray.
  b^1. Ground color of back grizzled brown .... *lateralis*.
  b^2. Ground color of back grizzled ash-gray .... *cinerascens*.
a^2. Inner stripe as large as outer; lateral hairs of tail with *one* black band; under side of tail fulvous or chestnut.
  c^1. Under side of tail deep *chestnut*; mantle ferruginous chestnut ..... *castanurus*.
  c^2. Under side of tail *fulvous*; mantle ochraceous .... *chrysodeirus*.

Faunal position.—Tamias lateralis and its relatives here described belong to the lower or southern zones of the Boreal province. They inhabit the Douglas Fir zone and the higher levels of the *Pinus ponderosa* zone, and are particularly fond of rocky hill-sides.

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*Bull. Am. Mus. Nat. Hist., New York, III, May, 1890, pp. 49-50.

TAMIAS CASTANURUS sp. nov.

Type No. $\frac{22733}{30197}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Park City, Wahsatch Mountains, Utah (altitude 7,000 feet), July 3, 1890. Collected by Vernon Bailey. (Original number, 1383.)

Measurements (taken in the flesh).—Total length, 284; tail vertebræ, 92; pencil, 32; hind foot, 43. Ear from crown, 13 (in dry skin).

Color.—Head and neck to shoulders ferruginous chestnut, lightest on the sides of the neck. Inner black stripe nearly as broad, long, and sharply defined as the outer, in this respect resembling *T. chrysodeirus* of the Wahsatch. Belly hairs dusky at base as in *T. chrysodeirus*, but tipped with whitish or very pale yellowish, the dusky base showing through. Tail above mixed yellow, black, and reddish brown, with yellow or fulvous border; tail below *deep chestnut*, with a submarginal black band. Upper surfaces of feet whitish. The ground color of the rump and outer side of the leg is darker and more strongly suffused with reddish-brown than in *T. chrysodeirus*.

General remarks.—This species is remarkably constant in coloration, as shown by a series of 44 excellent specimens (consisting of adults and young of both sexes) collected in the Wahsatch Mountains in June and July by Mr. Bailey. Almost the only variation from the type is in the amount of red in the mantle (some of the females having less than the type), and this is more constant than in the other species.

Mr. Bailey writes that these Ground Squirrels are "particularly abundant around the edge of town [Park City] and around the boarding-houses at the mines, where they pick up crumbs about the doors. A good many live along the roads, picking up the grain that falls from wagons. Of thirty-five stomachs examined, all but ten contained remains of insects (grasshoppers, beetles, flies, and larvæ). Most of them contained also seeds of plants, flowers, and foliage, and some were nearly full of roses. Many contained corn, beans, oats, bread, cake, potatoes, and fat pork picked up about camp."

TAMIAS CHRYSODEIRUS sp. nov.

Type No. $\frac{4666}{5720}$ ♂ ad. Merriam collection. From Fort Klamath, Oregon, July 31, 1888. Collected by Samuel Parker. (Original number, 143.)

Measurements.—Total length, 286; tail vertebræ, ——; pencil, 25; hind foot, 39; ear from crown, 13.

General characters.—Top of head, rusty chestnut; sides of neck, bright ochraceous, this color reaching forward on the sides of the face, backward to the shoulders, upward across the nuchal region, where it is grizzled with the black-tipped hairs of the back, and downward (though of a paler shade) completely across the throat, and brightest on the sides of the neck between the ears and shoulders. The three side stripes of equal breadth throughout; inner black stripe equaling the outer in length, breadth, and sharpness of definition; white stripe extending both anteriorly and posteriorly beyond the others, and being traceable in some specimens from the ears to the root of the tail. Under side of body everywhere strongly washed with pale ochraceous, which is deepest on the throat, where the hairs are of the same color throughout. Belly hairs dusky at base, with yellowish tips, the dusky showing through. Tail above, mixed black and yellow, with yellowish border; tail below, fulvous with a submarginal band of black. Upper surfaces of feet strongly suffused with ochraceous.

General remarks.—This species is represented in the Department of Agriculture collection by a series collected near Glenbrook, Nev., on the eastern side of Lake Tahoe, by Charles A. Keeler; and in the Merriam collection by series from Klamath, Oregon, collected by Samuel Parker; and Donner, Cal., collected by Charles A. Allen. The range of variation is slight and relates mainly to the intensity of color of the mantle, which varies from deep ochraceous or orange red to pale yellowish.

TAMIAS CINERASCENS sp. nov.

Type No. [illegible] ♀ ad. Merriam collection. From Helena, Montana (altitude 4,5 feet), August 13, 1888. Collected by C. Hart Merriam. (Original number, 4.)

Measurements.—Total length, 322; tail vertebræ, 108; pencil, 35; hind foot, 44; ear from crown, 9.

Color of type specimen, and of females generally in gray phase.—Upper parts, from nose to root of tail, clear ash-gray, grizzled with black-tipped hairs; no red anywhere, or at most a slight ochraceous tinge on shoulders or a few red hairs about head; white stripe broad, reaching from ears to hips, somewhat obscured over shoulders; black stripe broad, short, and obscured at both ends, the inner shorter than the outer; a reddish-brown wash on outer side of thighs; tail above grizzled black and gray, with yellowish border; tail below grizzled grayish-yellow with a broad submarginal black band and a narrower and less distinct (concealed) band on the basal half of the lateral hairs; under parts whitish, slightly tinged with yellowish, the dusky basal portion of the belly hairs showing through; feet whitish from ankles.

Males in red phase.—Similar to gray phase, but with top of head and neck and sides of neck from white of lower eyelid to shoulders, deep rusty chestnut; eyelids white; a whitish line from eye to ear, dividing the red; face in front of eye whitish.

General remarks.—The females when in the red phase are not nearly so red as the males; and no males in the gray phase were procured. The species is represented by specimens, all collected by myself at Helena, Mont., in August, 1888.

The relationships of *Tamias cinerascens* are with *T. lateralis*, not with *T. castanurus* or *T. chrysodeirus*.

B. DESCRIPTION OF A NEW SPECIES OF THE TAMIAS HARRISI GROUP.

The members of the *Tamias harrisi* group differ from all other American ground squirrels in possessing a single lateral stripe, white in color. Three forms have been thus far described, namely, the original *T. harrisi* of Bachman, which has the under side of the tail iron-gray and the lateral hairs black at base and marked with two free black bands; *T. leucurus* (described by the writer in Fauna No. 2, 1889, pp. 19–21), which has the under side of the tail white, with a single partly concealed submarginal black band; and *T. leucurus cinnamomeus* (described by the writer in Fauna, No. 3, 1890, pp. 51–53), which has the tail colored like the foregoing, but the upper parts suffused with cinnamon. The new species here described (*T. interpres*), while resembling *T. harrisi* and *T. leucurus* in the color of the upper parts, has the lateral hairs of the tail black at the base and marked with *two* free black bands as in *T. harrisi* from western Arizona, and the hairs of the under surface of the tail white as in *leucurus*. It resembles *leucurus* more than *harrisi*, and yet is more closely related to the latter. It is clearly intermediate between the two and still it does not connect them, there being room for an intervening form or 'intergrade' in each direction. Intergrades with *harrisi* will probably be discovered, so that it will rank eventually as a subspecies.

It may be known from the following description:

TAMIAS INTERPRES sp. nov.

Type No. $\frac{[illegible]}{[illegible]}$ ♀ ad. U. S. National Museum (Department of Agriculture collection. From El Paso, Texas, December 10, 1889. Collected by Vernon Bailey. (Original number, 762.)

Measurements (taken in flesh).—Total length, 226; tail vertebræ, 80; pencil, 22; hind foot, 37; ear from crown, 4 (in dry skin).

General characters.—Similar to *Tamias leucurus*, but tail longer and its lateral hairs marked with two free black bands instead of one.

Color (of type in winter pelage).—Upper parts finely grizzled gray, faintly tinged posteriorly with vinaceous, and suffused with pale fulvous over the nose; shoulders, hips, and outer surfaces of fore and hind legs ochraceous buff; a broad stripe of clear white on each eyelid and on each side of back from shoulders to side of rump; under parts silky whitish. Tail above with proximal third concolor with back and suffused with pale fulvous; distal two-thirds grayish black with a partly concealed submarginal black band and whitish border; tail below white, with two complete free black bands (the innermost concealed) and a whitish border. The lateral hairs of the tail are black at the very base, so that each hair has three black zones, alternating with three white zones, precisely as in *T. harrisi*. But it differs from *harrisi* in having the hairs of the under side of the tail whitish instead of marbled black and white, giving the tail a very different appearance.

The four forms may be easily identified by the following

KEY TO SPECIES AND SUBSPECIES OF THE TAMIAS HARRISI GROUP.

A.—Lateral hairs of tail with *one* free black band, under side of tail white:
  *b*¹. Upper parts grayish .... *leucurus.*
  *b*². Upper parts cinnamon .... *leucurus cinnamomeus.*
B.—Lateral hairs of tail with *two* free black bands:
  *c*¹. Under side of tail iron-gray (mixed black and white) .... *harrisi.*
  *c*². Under side of tail white .... *interpres.*

C. DESCRIPTION OF A NEW SUBSPECIES OF THE TAMIAS MINIMUS GROUP.

TAMIAS MINIMUS MELANURUS subsp. nov.

Type No. $\frac{23048}{30494}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From west side of Snake River near Blackfoot, Idaho, July 17, 1890. Collected by Vernon Bailey and Basil Hicks Dutcher. (Original number, 1451).

Measurements.—Total length, —; tail vertebræ, 84; pencil, 21; hind foot, 29; ear from crown, 7.5 (in dry skin).

General characters.—Similar to *Tamias minimus consobrinus* Allen, but with under side of tail black along the median line, bordered on each side with pale yellowish—thus exactly reversing the condition which prevails in all the other known species of the genus, the normal arrangement consisting of a light (usually yellowish or fulvous) median stripe, bordered by a submarginal band of black.

General remarks.—Specimens of this new form of the small, pallid chipmunk of the Great Basin have just been received from Vernon Bailey, chief field agent of the Division, and his assistants, Basil Hicks Dutcher and Clark P. Streator. They were collected on the Snake River Desert in Idaho, between Blackfoot and Big Lost River. Mr. Bailey writes me that they are replaced by the ordinary form (*T. minimus consobrinus*) in the immediate vicinity of Blackfoot, on the east side of Snake River. The Snake River Desert consists of sand and sage plains alternating with lava beds. Without knowing the exact haunts of the animal it is difficult to say whether its peculiar freak of tail coloration is *protective* (in harmony with the dark tints of the lava) or *directive* (in sharp contrast with the light colors of the sandy desert). I incline to the latter view.

The new form is here treated as a subspecies instead of a species, because specimens from Big Lost River are somewhat intermediate, having the usual submarginal black band on the basal third of the tail, while the central part is black beyond. (No. 23046 ♀, collected by Clark P. Streator, July 21, 1890, is of this character).

DESCRIPTION OF A NEW EVOTOMYS FROM COLORADO.

By Dr. C. HART MERRIAM.

Up to the present time no member of the circumpolar genus *Evotomys* has been recorded from the Rocky Mountain region of the United States, so far as I am aware. It is with great pleasure, therefore, that I am able to add to our fauna a new species of this genus from the mountains of Colorado.

The specimen on which the new species is based was collected near Gold Hill, Boulder County, Col., at an altitude of 9,500 feet, by Mr. Denis Gale, who very generously presented it to me along with an interesting collection of other mammals from the same region.

It may be known by the following description:

EVOTOMYS GALEI sp. nov.

GALE'S RED-BACKED MOUSE.

(Plate II, fig. 3.)

Type $\frac{4685}{5352}$ ♀ ad. Merriam collection. From Boulder County Colorado (altitude 9,500 feet), July 13, 1889. Collected by Denis Gale.

Size about equal to that of *E. gapperi*, or a little larger, but not so large as *E. carolinensis*. Unfortunately no measurements were taken in the flesh. The hind foot, after soaking to straighten the toes, measures 19. The tail in the dry skin measures about 42; pencil, 6.5. The ears are considerably larger than those of *E. gapperi* and the antitragus is relatively as well as actually much larger.

Color.—Above, considerably lighter than true *gapperi*; dorsal band well defined, pale hazel (not obscured by black-tipped hairs), extending from midway between the eyes and ears nearly to the tail; rest of upper parts 'Isabella-color,' suffused with ochraceous-buff. Below, white throughout, without trace of fulvous; basal half of fur of belly plumbeous. Tail sharply bicolor: above, 'Isabella-brown,' with a blackish tip; below, soiled white. There is no apparent post-auricular spot.

Cranial characters.—Compared with *E. gapperi*, the brain-case is broader, flatter, and more squarish in outline; immediately behind the orbits it spreads out more abruptly, and the postorbital process of squamosal is more prominent, so that the orbital and temporal fo are more sharply separated. A broad depression occupies the poste part of the frontals. The audital bullæ are large and high, but are inflated laterally than in *gapperi*. The zygomatic arches are somew expanded upward at the point of junction of the jugal with the zy matic process of the maxillary, showing a tendency toward the for tion of the vertical lamella seen in *Phenacomys* and the lemmings.

Dental characters.—The molar series are considerably larger tha skulls of *gapperi* of the same size, but are not so large as in *Phenaco* The last lower molar is slightly broader posteriorly than anteriorly (trary to the rule in *Evotomys*) and is broadest in the middle. It sists of three transverse loops, all of which are closed. The re-ent angles of the inner side are very deep; those on the outer side are respondingly shallow. The front lower molar has the usual numbe loops and triangles. The anterior loop is directed straight forward communicates broadly with the adjoining triangles on each side, leav one external and two internal closed (or nearly closed) triangles an posterior loop. The upper molars present no noteworthy peculiarit All of the molars in both jaws are rooted, each having two long well-formed roots, resembling those of *Phenacomys*, except that they not closed at the bottom. (See fig. 3.) They may be considered intermediate between those of *Evotomys rutilus* and *Phenacomys*.

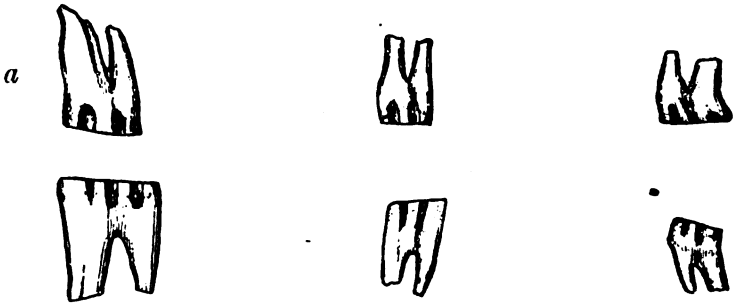

FIG. 3.—Molar teeth of *Evotomys galei* (*a*, left upper series; *b*, left lower series).

DESCRIPTIONS OF TWO NEW SPECIES OF EVOTOMYS FROM THE PACIFIC COAST REGION OF THE UNITED STATES.

By Dr. C. HART MERRIAM.

During the summer of 1889, Mr. Theodore S. Palmer made a biological reconnaissance of the Pacific coast region from northern California to Puget Sound, under the direction of the Division of Ornithology and Mammalogy of the Department of Agriculture. Among the interesting results of his explorations was the capture of two species of the circumpolar Arvicoline genus *Evotomys*, one as far south as Humboldt Bay, California. The only previous record of the genus from the Pacific region is Coues' mention of a specimen collected by Kennerly at Chilowk Lake, Washington, and referred to *E. gapperi*.* Species of the genus have been described by the writer from the Great Smoky Mountains in North Carolina and Tennessee, and from the Rocky Mountains in Colorado. It remains only to discover a form in the Sierra Nevada in order to complete the illustration of the typical distribution of a Boreal genus, extending its range southward along all the great mountain systems of the continent and throughout the humid Pacific coast region to the southernmost limits of the Boreal zones.

The new species collected by Mr. Palmer may be know from the following descriptions:

EVOTOMYS OCCIDENTALIS sp. nov.

WESTERN RED-BACKED MOUSE.

(Plate II, fig. 1.)

Type No. [illegible] ♂ ad. U. S. National Museum (Department of Agriculture collection). From Aberdeen, Chehalis County, Washington, August 16, 1889. Collected by Theodore S. Palmer. (Original number, 308.)

Measurements (taken in flesh).—Total length, 145; tail vertebræ, 45; Pencil, 3; hind foot, 18; ear from crown, 7.5 (in dry skin).

General characters.—Size medium, about equaling *E. gapperi;* tail rather long; coloration very much darker than in any other known form.

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* Mon. N. Am. Rodentia, 1877, 144.

Color.—Upper parts dark sepia-brown, with a broad dorsal area of burnt umber not sharply defined. Under parts salmon color, the dusky basal part of the fur sometimes showing through. Tail blackish above, slightly paler below, but not bicolor. Hind feet dusky.

Cranial and dental characters.—The skull of *Evotomys occidentalis* is small and narrow, with the brain case highly arched. The enamel folds of the molars are deep, those from opposite sides pressing strongly against one another as shown in the figure (plate II, fig. 1). The front lower molar has five projecting angles on the inner side and four on the outer. The last upper molar has four projecting angles on the inner side and three on the outer, with sometimes the suggestion of a fourth.

EVOTOMYS CALIFORNICUS sp. nov.

CALIFORNIAN RED-BACKED MOUSE.

(Plate II, fig. 2.)

Type No. $\frac{17841}{23926}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Eureka, Humboldt County, California, June 3, 1889. Collected by Theodore S. Palmer. (Original number, 110.)

Measurements (taken in flesh).—Total length, 161; tail vertebræ, 50; pencil, 5; hind foot, 21; ear from crown, 6 (apparently defective at tip; measured from dry skin).

General characters.—Compared with *E. occidentalis*, the present form is larger, with longer tail and hind feet and shorter ears (the margins of the ears appear to be imperfect, and may have been slightly longer). The tail is distinctly bicolor, which is not the case in *occidentalis;* it is dusky above and whitish below. There is less red in the dorsal area, and the black hairs are more conspicuous. The ground color above is lighter and has a grayish tint, especially on the sides, instead of being dark sepia-brown. The belly is white instead of salmon. The hind feet are much lighter.

Cranial and dental characters.—The skull is larger, broader, and flatter than that of *E. occidentalis*, its nearest relative; the frontals are depressed and concave between the eyes, and also broader interorbitally; the zygomatic arches stand out more strongly in front, and the parietals are very much broader and flatter. The dental characters are essentially the same as in *E. occidentalis.*

CRIPTION OF A NEW MARTEN (MUSTELA CAURINA) FROM THE NORTHWEST COAST REGION OF THE UNITED STATES.

By Dr. C. HART MERRIAM.

he marten inhabiting the dense spruce forests of the heavy rain-fall along the northwest coast from northern California to Puget Sound, doubtless ranging much farther north, differs specifically from the ern *M. americana* in both cranial and dental characters, and many he departures from the latter animal are in the direction of the old ld *M. zibellina*. It may be known from the following description:

MUSTELA CAURINA, sp. nov.

Type No. $\frac{2951}{3577}$ ♂ yg. ad. Merriam collection. From Chehalis County, Washington (coast near Gray's Harbor), February 4, 1886. Collected by L. C. Toney.

eneral characters.—In external appearance *Mustela caurina* differs e from *M. americana*, the chief difference being that the irregular kings of the throat and under surface generally are orange-red ind of whitish or yellowish. A female taken at the same place and he same day as the type has the flanks and even the upper parts ised with the same color, giving the animal a peculiarly rich and itiful appearance.

young female, less than half grown, was collected by Mr. T. S. ner, at Crescent City, in the extreme northwestern corner of Calia, June 19, 1889 (No. $\frac{17077}{23998}$ U. S. National Museum). It is very lly and the color is a uniform light seal brown, somewhat paler below, interrupted on the throat by a yellowish patch.

ranial characters.—The skull of *Mustela caurina* differs from that of *M. ricana* in the following particulars: The rostral portion is broader shorter; the audital bullæ are shorter and less inflated; the frontals broader both interorbitally and postorbitally; the shelf of the palate ss produced behind the plane of the last molar; the first upper prear is smaller and more crowded; the upper molars are larger; the er sectorial, in addition to its larger size, has the inner lobe very h larger and longer, projecting anteriorly beyond the plane of the rior lobe, *the reverse being* the case in *M. americana*; the last upper molar is not only larger, but has a much broader saddle; the transverse diameter of the tooth is about one-third greater than in *M. americana*, and the antero-posterior diameter of the inner lobe is both relatively and absolutely much greater; the distance between the outer alveoli of the upper canines equals the greatest length of audital bullæ instead of being much less; the transverse diameter of last upper molar is greater instead of less than the length of the upper sectorial; the length of the first lower molar is less instead of greater than the antero-posterior diameter of the last upper molar, and equals instead of exceeding the greatest breadth of the upper sectorial. The under jaw is in every way larger and heavier; the lower canine is not so strongly bent; the first lower premolar is smaller; the last lower molar is approximately of the same size; the lower sectorial is larger in both diameters; the three remaining lower teeth (second and third premolars and first molar) are uniformly shorter, thicker, and higher. The inner cusp of the lower sectorial is wanting in the male and nearly obsolete in the female.

The above cranial and dental comparisons have been made with specimens from the Adirondack Mountains in northern New York, and in both cases with skulls of corresponding sex and almost exactly the same size. The resulting absolute measurements, therefore, as well as the ratios, are available for direct comparison. Both of the skulls of *M. caurina* are young adults, while those of *M. americana* are a little older though by no means *old*. Hence the breadth of the frontals postorbitally in *M. caurina* is somewhat greater than if the skulls were fully adult.

Measurements of skulls of Mustela caurina and M. americana.

Measurements of skull.	*M. caurina*, Chehalis County, Wash.		*M. americana* Adirondacks New York	
	2578 ♂	2577 ♀	4927 ♂	4938
Basilar length from condyle to front of premaxillary	78	70.5	77.5	73 [illegible]
Basilar length of Hensel (from inferior lip of foramen magnum to posterior rim of alveolus of middle incisor)	70.7	63.5	70.5	[illegible]
Greatest zygomatic breadth	44.5	40.8	44.7	[illegible]
Breadth across postorbital processes	22.5	20	21	[illegible]
Least interorbital breadth	17.7	16.9	17.3	[illegible]
Least postorbital breadth	16.4	16.2	15.5	[illegible]
Distance from inferior lip of foramen magnum to postpalatal notch	33.2	30.5	33.3	[illegible]
Palatal length (from postpalatal notch to posterior rim of alveolus of middle incisor)	37.6	33	36.5	[illegible]
Length of lateral series of teeth on alveoli (from front of canine to back of last molar)	28	24.5	27.5	24.5
Greatest breadth across molars (on alveoli)	26	23	24	21
Greatest breadth across canines (on alveoli)	15	13.2	12.8	12.7
Greatest length of under jaw (single half)	52.6	42.5	50.5	45
Height of coronoid process from angle	23.5	21	23	18.5
Length of pterygoid fossa (from base of hamular to deepest part of postpalatal notch)	9.8	10.4	10.5	19
Length of shelf of palate behind plane of alveolus of last molars	6.2	6.3	7.7	[illegible]
Greatest length of audital bulla	15	13.3	16.5	[illegible]
Least breadth of muzzle behind canine	17.5	14	15	[illegible]
Measurements of teeth.				
Upper sectorial, length of crown	8.2	7.3	7.7	7
Upper sectorial, breadth of crown	5	4.5	4.7	[illegible]
Last upper molar, antero-posterior diameter of outer lobe	4	3.7	4	[illegible]
Last upper molar, antero-posterior diameter of inner lobe	5.5	4.5	4.7	4

easurements of skulls of Mustela caurina and M. americana—Continued.

Measurements of skull.	*M. caurina*, Chehalis County, Wash.		*M. americana*, Adirondacks, New York.	
	2578♂	2577♀	4927♂	4930♀
***Measurements of teeth*—Continued.**				
molar, antero-posterior diameter of saddle	3.6	3	3.7	3
molar, greatest transverse diameter	8.5	7.5	7.3	6.4
torial tooth, greatest length of crown	10	8.5	8.7	8
first lower molar	5.1	4.5	5.8	5.4
***Ratios of cranial and dental measurements*:**				
asilar length of Hensel:				
atic breadth	62.9	64.2	63.4	61
l length	53.1	51.9	51.9	51.4
of lateral series of teeth	39.6	38.5	39	38.1
th across molars	36.7	36.2	34	32.7
of upper sectorial tooth	11.5	11.4	10.9	10.9
h of lower sectorial tooth	14.1	13.3	12.3	12.4
th of postorbital constriction	23.1	25.5	21.9	22.5
h of under jaw	74.3	66.9	71.6	70
ngth of inner cusp to outer cusp of upper molar	13.7	12.1	11.7	12.1
length of inner cusp to transverse diameter of upper	64.7	60	64.3	59.7
readth to length of upper sectorial	60.9	61.6	61	52.8
ntero-posterior diameter of saddle of upper molar to same r of inner lobe	65.4	66.6	78.7	75
half basilar length (from condyle to front of premaxillary):				
atic breadth	114.1	115.6	115.2	111.2
l length	96.4	93.4	94	93.6
th of anteorbital constriction	45.3	47.8	44.6	43.8
th of postorbital constriction	42	45.8	40	40
h of lateral series of teeth	71.7	69.5	70.9	69.5
th across molars	61.6	65.2	61.9	55.6
th of last upper molar	21.7	21.2	18.8	19
h of upper sectorial	21	20.7	19.8	19.8
h of lower sectorial	25.6	24	22.4	22.6
h of first lower molar	13.5	12.7	14.9	15.3
nolar production of shelf of palate	15.8	17.8	19.8	17.3
h of audital bullæ	38.4	37.7	42.4	45.8
th of muzzle	44.8	39.6	38.4	37.6

DESCRIPTION OF A NEW SPECIES OF MOLOSSUS FROM CALIFORNIA (MOLOSSUS CALIFORNICUS).

By Dr. C. HART MERRIAM.

Molossus is a tropical American genus of bats, no species of which has been heretofore recorded from the United States, so far as I am aware. The subject of the present description is a huge animal, with immense ears, and of sooty-brown color. It was captured at Alhambra, in southern California, by Mr. E. C. Thurber, who writes me that it was found on the ledge over a door. Two others were caught during the same month December, 1889), and both in similar situations. Mr. Thurber says of ne of them: " It was hanging from the ledge of a window, swinging ack and forth and knocking against the window as if to attract atten-on. All were caught about 8 or 9 o'clock in the evening."

Mr. Henry W. Henshaw tells me that when encamped in southern alifornia several years ago, he saw and tried in vain to shoot, an enor-ous bat, much larger than any he had previously seen, which passed iftly by in the light of the camp fire.

The present species is closely related to *Molossus perotis* of Brazil. may be known from the following description:

MOLOSSUS CALIFORNICUS sp. nov.

Type No. 5736 ♀ ad. Merriam collection. From Alhambra, Los Angeles County, California, December 14, 1889. Collected by E. C. Thurber.

Dental formula.—Inc., $\frac{1-1}{2-2}$; c., $\frac{1-1}{1-1}$; pm., $\frac{2-2}{2-2}$; m., $\frac{3-3}{3-3}=30$. First upper lar minute, and wedged in angle between canine and second pre-lar, on the *outer* side. Second premolar large; higher than first lar. First lower premolar nearly as large as second. Lower incis-s bifid and crowded. Lower canines with cingulum forming a dis-ct cusp on inner side.

Muzzle very obliquely truncated, as in *M. perotis*, projecting 11^{mm} in ont of upper incisors and deeply notched between nostrils. Lips smooth, thout vertical wrinkles; a prominent glandular swelling in front of ch eye; side of head immediately above and behind eye concave.

Ears very large, their bases united in front, projecting slightly beyond zzle. Ear conch broadly convex anteriorly and posteriorly, slightly nvex on top, keel large and heavy, flattened externally. Tragus adrate, higher than broad. Antitragus twice as long as high, nearly ctangular, highest a little behind middle, and separated posteriorly conch by a deep notch. Inside of ear conch (facing outward) red in the form of a horseshoe, the hairs beginning on the superior margin of the keel about opposite angle of mouth and extending anteriorly the full length of the keel, thence curving upward (leaving a naked crescentic triangle in front) and reaching the upper border of the conch at the highest point anteriorly (on plane of nostrils) and thence, curving backward, forming a narrow fringe along the margin of the highest part of the conch and extending backward to a point opposite the angle of the mouth. The folds of the ear over the nose are densely haired on both surfaces, the hairs projecting forward over the nostrils. The anterior margin of the conch is reflexed and bare in front from the plane of the keel to the antero-superior rounded angle.

Upper surface of wing membrane with a line of hair along the posterior margin of distal three-fourths of fore-arm, expanding in the apex of angles between the fore-arm and fifth metacarpal, and fifth and fourth metacarpals, but not invading the narrow space between the fourth and third metacarpals. There is a small, scant-haired strip immediately behind the metacarpo-phalangeal articulation of the third digit. Antebrachial membrane naked in front of humerus, but haired in front of fore-arm, except at bottom of angle. No gular sac (may be present in male). Wings from junction of middle and distal third of tibia. Color sooty-brown, palest below, bases of hairs everywhere pale drab-gray.

Measurements of type specimen.

Head and body		**102**
Tail		**60**
Free part of tail		**13**
Head		**42**
Height of ear (from line of attachment above eye)		**24**
Length of ear (antero-posterior)		**39**
Tragus, height from anterior base		**4**
Tragus, breadth at top		**2.5**
Length of antitragal lobe		**11**
Humerus		**41**
Fore-arm		**73**
Longest finger		**136**
Thumb		**9**
Third finger	metacarpal	**72**
	1st ph	**31**
	2d ph	**28.5**
	cartilaginous claw	**8**
Fourth finger	metacarpal	**70**
	1st ph	**26**
	2d ph	**5**
	cartilaginous claw	**6**
Fifth finger	metacarpal	**38**
	1st ph	**22**
	2d ph	**6**
	cartilaginous claw	**5**
Tibia		**22.5**
Hind foot		**17**

DESCRIPTION OF A NEW PRAIRIE DOG FROM WYOMING.

By Dr. C. HART MERRIAM.

CYNOMYS LEUCURUS sp. nov.

Type No. $\frac{4565}{5315}$ ♀ ad. Merriam collection. From Fort Bridger, Wyoming, September 15, 1888. Collected by Vernon Bailey. (Original number, 224.)

Measurements (taken in flesh).—Total length, 335; tail vertebræ, 53; pencil, 21 (worn—much longer in other specimens); hind foot, 58; ear from crown, 3 (in dry skin).

General characters.—Similar in size and general appearance to *C. gunnisoni*, of Baird, but readily distinguished from the latter by the color of the tail and by cranial characters.

Color (of type which has nearly completed the change from summer o fall pelage).—Upper parts from nose to basal half of tail grizzled graysh buff, much mixed with black over the posterior part of back and ump; a broad, blackish patch over each eye, and a larger patch, grizled with buffy, on each cheek below the eye; thighs buff, not mixed 'ith black; under parts generally soiled buffy white, deepest at base f tail; throat and under side of face whitish. Tail, basal half conolor with upper and lower surfaces of body respectively; terminal half 'hitish all round without trace of dark bar. Specimens in summer pelge are uniformly buffy or grayish yellow above, the black hairs being carce and not noticeable, except on close examination. One specimen s almost brick red above, which may be due to staining from the soil. Specimens of *Cynomys leucurus* in summer pelage average lighter in oloration than *C. gunnisoni*, and in fall pelage there is more black on he back. But the principal and most conspicuous difference is in the oloration of the tail, which in *gunnisoni* is concolor with the body, has submarginal and subterminal black band, the tips of the hairs only eing white; while in *leucurus* the black band is absent and the terminal half or two-thirds of the tail is white. Moreover, the tail is shorter n *leucurus* than in *gunnisoni*.

Professor Baird pointed out the striking difference in the tail of this pecies as compared with that of *gunnisoni*, but having only two speciens of the present form and one of *gunnisoni* he did not separate them.

Cranial characters.—The skull of *C. leucurus* agrees in the main with that of *C. gunnisoni* as contrasted with *C. ludovicianus*, but differs from *gunnisoni* in the following particulars: The occiput (viewed from behind) is broader and flatter, and the mastoids are larger, flatter, and more completely in the occipital plane; the audital bullæ are larger and the meatus is less produced laterally; the nasals end more anteriorly compared with the nasal branches of the premaxillaries; the greatest breadth across the nasal branches of the premaxillaries equals or exceeds the interorbital breadth; the antero-inferior angle of the zygomatic arch is thickened so as to form a small triangular plate (instead of being rounded off as in *gunnisoni*).

The cranial differences which separate *Cynomys leucurus* from *C. ludovicianus* are numerous and marked, as may be seen by consulting the following table, in which the differential characters are arranged antithetically:

CYNOMYS LUDOVICIANUS.	CYNOMYS LEUCURUS.
Audital bullæ.	
Moderate; constricted below meatus; meatus small.	Much inflated; not constricted below meatus; meatus large.
Greatest breadth across audital bullæ equals distance from anterior lip of foramen magnum to—	
Second molar (fourth molariform tooth).	First molar (third molariform tooth).
Basi-occipital (on median line).	
Longer than broad.	As broad as long.
Plane of occiput (viewed from behind).	
Arched, with mastoid portion small and anterior to plane of ex-occipitals.	Depressed, with mastoid portion large and on same plane with exoccipitals.
Frontal shield.	
As broad as long.	Much longer than broad.
Interorbital breadth.	
Almost equal to distance from postorbital process to fronto-maxillary suture.	One-third narrower than distance from postorbital process to fronto-maxillary suture.
Nasals ending posteriorly.	
About on line with nasal branch of premaxillary.	Anterior to nasal branch of premaxillary.
Nasal branch of premaxillary.	
Ending about on line with fronto-maxillary suture. Widest at anterior edge of zygomatic process of maxillary.	Ending considerably posterior to fronto-maxillary suture. Of uniform width throughout.

CYNOMYS LUDOVICIANUS.	CYNOMYS LEUCURUS.
Greatest breadth across premaxillaries.	
ch less than interorbital breadth.	Equal to or greater than interorbital breadth.
Zygomatic arch with antero-inferior angle.	
arp, and thickened to form a heavy triangular plate.	But slightly thickened.
Coronoid process of mandible.	
ort, thick, and only slightly recurved.	Longer, more slender, and more strongly recurved.
Upper molar series.	
re than twice as far apart anteriorly as posteriorly.	Not more than twice as far apart anteriorly as posteriorly.
Last lower molar.	
ch longer than broad, with posterior cusp produced.	About as broad as long, with posterior cusp shortly rounded off.

DESCRIPTIONS OF THREE NEW GROUND SQUIRRELS OF THE SPERMOPHILUS SPILOSOMA GROUP.

By Dr. C. Hart Merriam.

In 1833 E. T. Bennett* published descriptions of a number of new ecies of mammals said to have been obtained in "that part of Cali-rnia which adjoins to Mexico." The exact locality from which these ecimens came has always been in doubt. It has been long known at they did *not* come from any part of California, but from some part Mexico. Prof. Baird supposed the locality to have been somewhere southeastern Sonora, while Bachman believed it to have been in rtheastern Sonora, or even Chihuahua east of the Sierra Madre. is uncertainty as to the type locality of so many species has always en a matter of annoyance to those who have had to do with the spe-s in question. Among these species is a small spotted spermophile ich Bennett named *Spermophilus spilosoma*. I shall not attempt to the type of this species, but assume for the present that it agrees in main with specimens from northern Mexico and extreme western xas. Regarding it as a central type, the related species which have en thus far described are the following: *Spermophilus obsoletus* Ken-ott, from western Nebraska, and three forms described by the writer orth American Fauna, No. 3, pp. 55–58), namely, *S. cryptospilotus*, *S. ilosoma pratensis*, and *S. spilosoma obsidianus*. To these, one additional ecies and two subspecies are here added, making eight in all. The quisition of the material on which all of the six new forms are based is e entirely to the biological explorations conducted by the Division of nithology and Mammalogy of the Department of Agriculture. The ational Museum contains, outside of the Department of Agriculture llection, but two skins of the *spilosoma* group (collected nearly forty ars ago by the Mexican Boundary Survey), and five of *obsoletus*. The epartment of Agriculture series now numbers nearly sixty excellent ins, accompanied in each case by the skull.

The new forms may be distinguished from those previously known by e following descriptions:

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* *Proceedings of the Zoological Society of London*, 1833, 40–41.

SPERMOPHILUS CANESCENS sp. nov.

Type No. [illegible] ♂ im. U. S. National Museum (Department of Agriculture collection). From Wilcox, Cochise County, Arizona, November 16, 1889. Collected by Vernon Bailey. (Original number, 676.)

Measurements (taken in flesh).—Total length, 156; tail vertebræ, 55; pencil, 10; hind foot, 28; ear from crown, 2 (in dry skin). [Specimen not full grown.]

General characters.—Similar to *Spermophilus spilosoma*, but with ground color drab-gray, without any tinge of fulvous or rufous and with the white spots tending to coalesce laterally into irregular wavy transverse bars, which are so close together that the distance between them is less than the width of the markings. Basal third of tail cylindrical; distal two-thirds distichous.

Color.—Upper parts drab-gray, much obscured by hoary; head and face hoary; back everywhere covered with transversely elongated whitish markings, which are much crowded and tend to run together laterally, forming transverse wavy bars, separated by narrower dark wavy lines consisting of the dark tips of the hairs. Eyelids and under parts white. Tail above, grizzled grayish-drab, mixed with blackish on the terminal third, and bordered with buffy; tail below, buffy with a submarginal blackish band.

SPERMOPHILUS SPILOSOMA MACROSPILOTUS subsp. nov.

Type No. $\frac{16759}{23663}$ ♀ ad. U. S. National Museum (Department of Agriculture collection). From Oracle, Pinal County, Arizona, June 11, 1889. Collected by Vernon Bailey. (Original number, 129. Teats, $\frac{5}{4}$.)

Measurements (taken in flesh).—Total length, 220; tail vertebræ, 74; pencil, 19; hind foot, 30; ear from crown, 3 (in dry skin).

General characters.—Size medium; ground color above russet-hazel; dorsal spots large, distinct, and far apart.

Color.—Ground color above, russet-brown, slightly paler over the nose; top of head and neck mixed with light-tipped hairs; dorsal spots very large, distinct, distant, roundish in outline, and indistinctly bordered posteriorly with dusky; under parts whitish. Tail above, proximal half concolor with back; distal half mixed buffy and black with a buffy border. Tail below, pale ochraceous buff with a partly concealed submarginal black band.

General remarks.—The above description applies in every particular to three adult specimens from Oracle. The young differ in being brighter colored and in having the dorsal spots smaller, less spaced, and not so round.

SPERMOPHILUS SPILOSOMA MAJOR subsp. nov.

Type No. $\frac{17116}{24049}$ ♀ ad. U. S. National Museum (Department of Agriculture collection). From Albuquerque, New Mexico, July 22, 1889. Collected by Vernon Bailey. (Original number, 225. Teats, $\frac{4}{3}$.)

Measurements **(taken in flesh).—Total length, 234; tail vertebræ, 80; pencil, 18; hind foot, 35; ear from crown, 3 (in dry skin).**

General characters.—This is the largest member of the group thus far discovered, and its color is different from any of the others, being intermediate between *spilosoma* and *obsoletus*.

Color.—Ground color above broccoli brown, tinged with pale fulvous over the nose. Spots indistinct and ill defined, bordered posteriorly with dusky; most numerous over the rump. Under parts white. Tail above, proximal half pale reddish-brown, distal half buffy brown with a submarginal black band, bordered with pale buff; tail below, buffy with a partly concealed submarginal black band.

General remarks.—A series of a dozen specimens of this subspecies, collected at Albuquerque in July, 1889, by Mr. Bailey, shows the changes resulting from differences in age and in the wear of the pelage. In the young the upper parts are pale vinaceous-cinnamon, the dorsal spots are much more distinct, and both sides of the tail more reddish-brown than in the adults. Adults in worn pelage have the tail pale cinnamon-rufous, and the upper parts faintly tinged with reddish-brown—exposed by the wearing away of the light tips of the hairs.

In color and markings, *Spermophilus spilosoma major* is intermediate between *S. spilosoma* and *S. obsoletus*, though it lacks the coal-black edgings to the indistinct spots of the latter, and is larger than either.

DESCRIPTIONS OF THREE NEW KANGAROO RATS, WITH REMARKS ON THE IDENTITY OF DIPODOMYS ORDII OF WOODHOUSE.[*]

By Dr. C. Hart Merriam.

In North American Fauna, No. 3, I proposed the genus *Dipodops* for the kangaroo rats having five toes on the hind feet, as distinguished from *Dipodomys* proper, which has but four toes.[†] In several instances the external resemblances between species belonging to one genus and those belonging to the other are so exceedingly close that it is unsafe to name museum specimens without actually counting the toes. The most extraordinary and perplexing instance of this kind which has come to my notice is that of two species inhabiting the same localities at El Paso, Tex. They are so much alike in size, color, and proportions, that, without reference to the number of toes, the closest scrutiny is necessary to discriminate between them. In fact, the differences are so slight that a naturalist of note has suggested to me that they might be one and the same species, the presence or absence of the useless digit being a mere individual variation, as is known to be the case in the kittiwake gull (*Rissa tridactyla*). The possibility of such a parallel was so contrary to the results of my study of the group (having examined several hundred specimens without finding a single instance of individual variation, either in the number or relative size of the digits) that I felt impelled to make a particularly critical study of the El Paso kangaroo rats for the purpose of ascertaining the facts in the case. Owing to the indefatigable zeal of the chief field naturalist of the Division, Mr. Vernon

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[*] It was my intention to publish a revision of the North American kangaroo rats in the present number of Fauna, but unforeseen delays, particularly in securing proper illustrations, have prevented.

[†] I am aware that Dobson has published a special paper "On the Unimportance of the Presence or Absence of the Hallux as a Generic Character in Mammalogy" (Proc. Zool. Soc. London, 1884, 402–403); but his argument was based wholly upon a study of the hallux in the insectivorous hedgehogs (*Erinaceus*), a group which presents, according to his own statement, all intermediate conditions in the development of thi digit, and in one species of which (*E. albiventris*) Dr. Dobson found an individual, an old female, which had a hallux on the left foot but not on the right. No such variations occur in the genus *Dipodops*; in fact, the constancy in the length of the hallux in the several species is remarkable, as will appear in my forthcoming paper on the group.

Bailey, a series of sixteen beautifully prepared specimens was available, including both sexes and different ages of both species, accompanied by tables of measurements taken in the flesh. The results of this study may be briefly stated: The two forms may be distinguished without counting the toes, by external differences of color and proportions, constant though slight, and by numerous cranial characters. (The latter are pointed out under the head of *Dipodomys ambiguus*, where the cranial characters of the two animals are contrasted in detail.) Therefore, notwithstanding the close external resemblance of the two El Paso kangaroo rats, they really are not closely related at all, but belong to distinct genera. Mr. Bailey, who collected the specimens, writes me that he had no difficulty in distinguishing them in the flesh, the *Dipodops* being stouter and heavier than the *Dipodomys*, and having a thicker and shorter tail.

Careful comparison of Woodhouse's original description of *D. ordii* from El Paso, Tex., with the present excellent series of both forms from the same locality, has convinced me that *D. ordii* is the 5-toed animal (a *Dipodops*) leaving the 4-toed (a *Dipodomys*) to be described. The latter is here named *Dipodomys ambiguus*, and *Dipodops ordii* is redescribed from abundant material accompanied by trustworthy measurements taken in the flesh.

DIPODOMYS AMBIGUUS sp. nov.

Type No. $\frac{18147}{25045}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From El Paso, Texas, December 13, 1889. Collected by Vernon Bailey. (Original number, 782.)

Measurements (taken in flesh).—Total length, 233; tail vertebræ, 133; pencil, 32; hind foot, 37; ear from crown, 7; from anterior root, 12 (in dry skin).

General characters.—Hind toes, 4; size rather small for a true *Dipodomys.* Terminal third of tail crested-penicillate. Closely resembles *Dipodops ordii*, from the same locality, but is more slender and the color of its upper parts is buffy-drab instead of deep ochraceous-buff.

Color.—Upper parts buffy-drab, brightest on the sides, where it is faintly tinged with pale ochraceous-buff, and everywhere mixed with black-tipped hairs, which are most conspicuous on the rump. Upper tail-stripe dusky from basal ring to extreme tip, the bases of the hairs white; lower tail-stripe dusky, and when unworn reaching the dusky tip, leaving a white stripe on each side which ends about opposite the end of the vertebræ.

Cranial characters.—Compared with *Dipodops ordii* the skull of *Dipodomys ambiguus* is broader interorbitally; the length of the nasals is about equal to the interorbital breadth at plane of lachrymals; the *expanded* orbital bridge of the maxillary ends postero-laterally in a small *projecting* lobule, with a concavity in front of it; the breadth of the frontals posteriorly is about equal to the distance from the foramen magnum to the incisive foramina, and is considerably greater than the distance from front of incisor to back of last molar; the postero-superior angle of the squamosal is sharply angular; the height of cranium above symphysis of audital bullæ is much less than the interorbital breadth at plane of lachrymals; the angular process of mandible is relatively short and blunt; the breadth of the skull across the inflated mastoids equals the distance from the anterior lip of the foramen magnum to the posterior rim of alveolus of incisor; the greatest breadth across the zygomatic processes of the maxillaries equals the distance from occipital condyle to front of incisive foramina.

Dipodomys ambiguus is closely related to *D. merriami*, recently described by Dr. Mearns,* but differs from it in having shorter ears and tail and longer hind feet. The thigh patch is very much smaller—hardly a third as large as in *D. merriami.* Unfortunately, the skull of the latter has been lost, so that no cranial comparisons can be made. The examination of specimens from intermediate localities may result in reducing *ambiguus* to subspecific rank.

CRANIAL CHARACTERS OF *Dipodomys ambiguus* CONTRASTED WITH THOSE OF *Dipodops ordii.*

DIPODOPS ORDII.	*DIPODOMYS AMBIGUUS.*
Interorbital breadth at fronto-parietal suture.	
= Distance from front of incisor to back of last molar.	Much longer than distance from front of incisor to back of last molar.
= Distance from parietals to middle of nasals.	Longer than distance from parietals to middle of nasals.
= Distance from foramen magnum to front of molar series.	Much longer than distance from foramen magnum to front of molar series.
Considerably less than distance from foramen magnum to incisive foramina.	About equal to distance from foramen magnum to incisive foramina.
Less than distance from fronto-premaxillary suture to interparietal.	About equal to distance from fronto-premaxillary suture to interparietal.
Breadth of orbital bridge of maxillary.	
Much less than width of rostrum across widest part of premaxillaries.	= Breadth of rostrum across widest part of premaxillaries.
Expanded orbital bridge of maxillary.	
Narrowly rounded off postero-laterally, without trace of projecting lobule.	Ending postero-laterally in a projecting lobule.
Post-palatal notch.	
Reaching plane of interspace between second and third molars.	Barely reaching plane of middle of last molar.

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* Bull. Am. Mus. Nat. Hist., N. Y., ii, 290–291. Separates issued February 21, 1890.

	DIPODOPS ORDII.	*DIPODOMYS AMBIGUUS.*
Length of nasal bones.	Much greater than inter-orbital breadth at plane of lachrymals.	Equal to interorbital breadth at plane of lachrymals.
Breadth of middle portion of basi-occipital.	About half, or less than half, its length.	Considerably more than half its length.
Tympanic capsule terminating anteriorly.	On same plane with inflated mastoid, the two together forming a uniformly rounded mass.	In a blunt projection below the inflated mastoid, the latter being concave or emarginate immediately above it.
Postero-superior angle of squamosal.	Broadly rounded.	Sharply angular.
Greatest vertical depth of inflated mastoid.	= Length of nasals.	Less than length of nasals.
Height of cranium above symphysis of audital bullæ.	= Interorbital breadth.	Much less than interorbital breadth.
Condylar process of mandible.	Twice as long as broad.	Nearly as broad as long.
Angular process of mandible.	Very long and sharp (distance from tip to tip much greater than distance from condyle to tip of incisors).	Relatively short and blunt (distance from tip to tip about equal to or slightly exceeding distance from condyle to tip of incisors).
Greatest breadth of cranium across inflated mastoids.	Exceeds distance from anterior lip of foramen magnum to alveolus of incisor.	Equals distance from anterior lip of foramen magnum to alveolus of incisor.
Greatest breadth across maxillaries.	Equals distance from occipital condyle to posterior border of incisive foramina.	Equals distance from occipital condyle to anterior border of incisive foramina.

Measurements (taken in the flesh) of Dipodomys ambiguus from El Paso, Texas.

National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remarks.
			1889.					
$\frac{18143}{25041}$	768	El Paso, Tex	Dec. 11	♂	252	147	38	
$\frac{18145}{25043}$	775	...do	Dec. 12	♂	236	141	38	
$\frac{18147}{25045}$	782	....do	Dec. 13	♂ ad.	233	133	37	Type.
$\frac{18139}{25037}$	783	....do	Dec. 13	♂ ad.	245	145	38	
$\frac{18146}{25044}$	794	do	Dec. 14	♀ im.	240	145	38	
$\frac{18148}{25046}$	795	....do	Dec. 14	♂	250	154	37	
$\frac{18149}{25047}$	800	....do	Dec. 15	♂ ad.	257	155	39	
$\frac{18144}{25042}$	801	....do	Dec. 15	♀	248	152	38.5	
$\frac{18140}{25038}$	806	....do	Dec. 17	♂	261	154	39	
$\frac{18136}{25034}$	807	....do	Dec. 17	♂	251	150	38.5	
$\frac{18138}{25036}$	818	....do	Dec. 18	♀ im.	210	111	39	
$\frac{18137}{25035}$	808	....do	Dec. 17	♀ im.	250	149	38	

DIPODOPS ORDII Woodhouse.

Duplicate type No. $\frac{18135}{25033}$ ♀ ad. U. S. National Museum (Department of Agriculture collection). From El Paso, Texas, December 11, 1889. Collected by Vernon Bailey. (Original number, 769.)

Measurements **(taken in flesh).—Total length, 240; tail vertebræ, 134; pencil, 30; hind foot, 38. Ear from crown, 7; from anterior base, 12 (in dry skin). Length of hallux from heel, 20.**

General characters.**—Hind toes, 5; size, medium; form, stout and thick set, with a thick tail; tail, crested-penicillate on terminal third; general color, deep ochraceous-buff, brightest on the sides.**

Color.**—Upper parts from tip of nose to base of tail, and extending down outer side of leg to heel, deep ochraceous-buff varying to ochraceous, darkest on the back and brightest on the sides, not conspicuously mixed with black-tipped hairs except on the rump. Upper tail-stripe dusky from basal ring to extreme tip, the hairs white at base; under tail-stripe dusky, sometimes reaching and sometimes falling short of the dusky tip. Lateral tail-stripes white, reaching to or a little beyond end of vertebræ.**

Cranial characters.**—Compared with *Dipodomys ambiguus* from the same locality (El Paso, Tex.), the skull of *Dipodops ordii* is narrower**

interorbitally; the length of the nasals is considerably greater than the interorbital breadth at plane of lachrymals; the expanded orbital bridge of the maxillary is shortly rounded off postero-laterally; the breadth of the frontals posteriorly is considerably less than the distance from the foramen magnum to the incisive foramina, and about equals the distance from front of incisor to back of last molar; the postero-superior angle of squamosal is broadly rounded; the height of cranium above symphyses of audital bullæ equals interorbital breadth at plane of lachrymals; the angular process of mandible is relatively long and sharp. The cranial characters of *Dipodops ordii* have been contrasted with those of *Dipodomys ambiguus* under the head of the latter animal.

Measurements (taken in the flesh) of Dipodops ordii, from El Paso, Texas.

National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
			1889.				
$\frac{18142}{25040}$	763	El Paso, Tex	Dec. 10	♂	231	133	38
$\frac{18135}{25033}$	769	....do	Dec. 11	♀	240	134	38
$\frac{18141}{25039}$	781	....do	Dec. 13	♂ ad.	240	138	37
$\frac{18150}{25048}$	802	....do	Dec. 16	♂ juv.	210	120	39
$\frac{18134}{25032}$	764	....do	Dec. 10	♂	231	131	38

DIPODOMYS SPECTABILIS sp. nov.

Type No. $\frac{17858}{24973}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Dos Cabezos, Cochise County, Arizona, November 22, 1889. Collected by Vernon Bailey. (Original number, 695.)

Measurements (taken in flesh).—Total length, 350; tail vertebræ, 211; pencil, 30; hind foot, 52. Ear, from crown, 10; from anterior base, 16 (in dry skin).

General characters.—Largest of the genus, equaling or even surpassing *D. deserti* in size. Tail with hairs nearly twice as long as head and body and very handsome, having a long terminal brush of pure white surmounting a broad band of black; hairs on proximal half of tail short and appressed; of terminal half, long and free; at the same time the tail is not distinctly crested above as in several other species.

Color.—Upper parts, from nose to root of tail, ochraceous-buff mixed with black-tipped hairs, brightest and purest on the sides, palest on the cheeks, and mixed with clay-color on the head. Hip patch ochraceous, becoming dusky as it passes down the leg and dilating behind the ankle so as to form a large blackish spot which reaches the heel.

upraorbital white spot obscured. Upper and lower tail stripes dusky, eeting a little behind the middle and forming a broad black subterminal and (occupying about one-third the total length of the tail), beyond hich is a large terminal brush of pure white. The white side-stripes isappear a little beyond the middle of the tail.

Cranial characters.—Skull large and heavy for a *Dipodomys*. Inflated mastoids separated on top of the skull by about 3mm, so that there is a distinct interparietal, cuneate in shape. In *D. deserti*, the only species approaching *D. spectabilis* in size, the mastoids meet immediately behind the parietals, having at most an inconspicuous spicule between them. The two species differ further in the maxillary bridge of the orbit, which is fully a third broader in *spectabilis* than in *deserti*, and in the inter-orbital breadth of the frontal, which is much greater in the former. *D. deserti* has the flattest skull of any known member of the genus; in *D. spectabilis* it is higher and the mastoids are more rounded. In *D. spectabilis* the antero-posterior diameter of the orbit just outside of the lachrymal is equal to or less than the length of the fronto-maxillary suture, while in *deserti* it is much greater. In *D. spectabilis* the breadth of cranium across inflated mastoids equals the distance from anterior lip of foramen magnum to tips of upper incisors (falling far short of alveolus) while in *deserti* the mastoid breadth equals distance from same point to front of alveolus of upper incisor. In *D. spectabilis* the greatest breadth across maxillaries equals distance from occipital condyle to front of incisive foramina, in *deserti* to posterior border of same foramina. In *D. spectabilis* the condylar process of the mandible is broader and bent upward at a stronger angle than in *deserti*, and the transversely elongated angular process is very much longer.

General remarks.—This elegant species presents the darkest tail and richest coloration known in the genus, while its nearest relative (*D. deserti*) is distinguished from all others by the pallor of its colors. In some respects *D. spectabilis* resembles the type of the genus (*D. phillipsi*), but it is very much larger and requires no comparison with that species. *D. spectabilis* inhabits a wide range of country in the lower Sonoran faunal province. The Department of Agriculture series consists of thirty beautifully prepared skins and skulls (all collected by Mr. Bailey), from the following localities: Oracle, Calabasas, and Dos Cabezos, Ariz.; Deming and Albuquerque, New Mexico; Sierra Blanca, Tex.; and Magdalena, Sonora, Mexico. The largest specimens are from Albuquerque and may merit subspecific separation.

The following table of measurements affords an index to the variation in size in the several localities.

Measurements (taken in flesh) of thirty specimens of Dipodomys spectabilis from vari localities.

National Museum No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Remar
16821 23732	139	Oracle, Ariz	1889. June 12	♂ ad.	352	206	52	
16822 23733	140	....do	June 12	♂ im.	341	202	51	
16823 23734	141	....do	June 12	♀ ad.	330	193	47	
17745 24686	605	Calabasas, Ariz	Oct. 26	♂ ad.	328	187	50	
17746 24687	606	....do	Oct. 26	♀	313	179	49	
17747 24688	610	....do	Oct. 27	♂ ad.	325	196	44	
17748 24689	611	....do	Oct. 27	♀	315	184	48	
17749 24690	612	....do	Oct. 28	♀	325	194	45.5	
17750 24691	614	....do	Oct. 29	♂ ad.	310	200	52	
17751 24692	615	....do	Oct. 29	♀	330	200	50	
17752 24693	616	....do	Oct. 29	♀	325	193	48	
17753 24694	617	....do	Oct. 29	♂ ad.	333	198	48	
17754 24695	618	....do	Oct. 29	♀	335	204	47	
22652	619	....do	Oct. 29	♂ ad.	320	192	48	
17886 24823	695	Dos Cabezos, Ariz	Nov. 22	♂ ad.	350	211	52	Type.
17887 24824	702	....do	Nov. 23	♀ im.	331	190	51	
17888 24825	703	....do	Nov. 23	♀	335	194	51	
17889 24826	704	....do	Nov. 23	♀	350	209	54	
17820 24757	620	Magdalena, Mexico	Nov. 2	♀	320	183	48	
17821 24758	621	....do	Nov. 2	♂ ad.	320	187	48	
17131 24064	226	Albuquerque, N. Mex	July 23	♂ ad.	355	220	56	
17133 24066	227	....do	July 23	♂ ad.	390	236	57	
17132 24065	230	....do	July 24	♀	350	215	55	
18019 24930	753	Deming, N. Mex	Dec. 5	♀ ad.	356	206	52	
18065 24964	754	....do	Dec. 6	♂ ad.	345	203	54	
18066 24965	755	....do	Dec. 6	♀ juv.	220	123	48	
18067 24966	756	....do	Dec. 6	♂ juv.	218	126	48	
18092 24990	822	Sierra Blanca, Tex	Dec. 21	♀	365	217	55	
18091 *24989*	*819*	....do	Dec. 25	♀	333	196	52	
18093 *24991*	*831*	....do	Dec. 26	♂	294	169+	52	

DIPODOMYS CALIFORNICUS sp. nov.

Type No. $\frac{16618}{23544}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Ukiah, Mendocino County, California, May 4, 1889. Collected by Theodore S. Palmer. (Original number, 46.)

Measurements (taken in flesh).—Total length, 302; tail vertebræ, 183; ind foot, 43; pencil, 16. Ear, from crown, 9; from anterior base, 16 in dry skin).

General characters.—Size medium, about equaling *D. agilis;* ears arge; tail long, with a pure white pencil; tail crested penicillate, but rest not conspicuous; color darker than in any other known species of he group.

Color.—Upper parts from nose to band across thigh sepia-brown, sufused with pale ochraceous-buff, which is brightest on the sides. Thigh atches large, becoming dusky in passing down the legs, and forming black spot behind and on the sides of the ankle. Eyelids black, upraorbital white spot distinct; black mark at base of whiskers large nd distinct. Upper and lower tail stripes black, meeting a short disance in front of terminal pencil, which is pure white.

Cranial characters.—Top of skull considerably arched (relatively); nastoids about 3^{mm} apart; interparietal not twice as long as broad; eight of brain case above symphysis of audital bullæ considerably greater than breadth of united frontals between lachrymals; lachrymals arge; expanded orbital bridge of maxillary broad; interorbital breadth at posterior border of frontals equal to distance from inferior lip of foranen magnum to center of crown of premolar; breadth across inflated nastoids equal to distance from occipital condyle to front of incisive oramina; greatest breadth across zygomatic processes of maxillaries qual to distance from occipital notch to nasals; angular process of nandible long and pointed.

Measurements (taken in flesh) of Dipodomys californicus.

National Museum No.	Original No.	Locality.	Date.	Sex	Total length.	Tail vertebræ.	Hind foot.	Remarks.
			1889					
16617 23543	32	Ukiah, Cal	April 28	[illegible]	287	170	44	
16618 23544	46	do	May 4	[illegible]	302	183	43	Type.
16619 23545	47	do	May 4	[illegible]	295	180	44	
16620 23546	52	do	May 7	[illegible]	305	181	43	

DESCRIPTION OF A NEW POCKET GOPHER OF THE GENUS GEOMYS, FROM WESTERN NEBRASKA.

By Dr. C. HART MERRIAM.

Numerous specimens of pocket gophers received from the sand hills of western Nebraska differ from typical *Geomys bursarius* of the Mississippi Valley in paler coloration, and in never attaining the size of full-grown individuals of the latter species. For the present the new form will be treated as a subspecies as follows:

GEOMYS BURSARIUS LUTESCENS subsp. nov.

Type No. $\frac{16677}{23536}$ ♀ ad. U. S. National Museum (Department of Agriculture collection). From Sand Hills, Birdwood Creek, Lincoln County, Nebraska, May 27, 1889. Collected by A. B. Baker.

Measurements (taken in flesh).—Total length 265; tail vertebræ 86; hind foot 33.

Color.—Upper parts uniform buffy-clay color except the nose, which is dusky. Under parts similar to the upper, but paler, and with the plumbeous basal fur showing through.

Cranial characters.—Compared with skulls of *Geomys bursarius* of the same size, *G. bursarius lutescens* is heavier, with more strongly developed ridges and processes. The inflated mastoids are larger, occupying a larger part of the occipital plane of the skull, and bulging further posteriorly. The audital bullæ also are somewhat larger.

DESCRIPTION OF A NEW SPECIES OF HESPEROMYS FROM SOUTHERN FLORIDA.

By Dr. C. HART MERRIAM.

In the spring of 1889, Mr. Morris M. Green, an assistant in the Division of Ornithology and Mammalogy, was sent to southeastern Florida for the purpose of studying its fauna and collecting the mammals and birds of the region. Among other specimens of interest he brought back a dozen skins and skulls of a large and highly-colored white-footed mouse, which has not been described. It belongs to a subtropical group, and is closely related to *Hesperomys floridanus* Chapman.[*] Two were captured at Canaveral and ten at Lake Worth (on the east side of the lake). Mr. Green states that "they burrow in the sand and eat the seeds of scrub-palmettoes, but are most common in parts of the scrub where there are few scrub-palmettoes and many scrub-oaks." The new species may be known from the following description:

HESPEROMYS MACROPUS sp. nov.

(Plate III, teeth.)

Type No. $\frac{16682}{23513}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Lake Worth, Florida, May 5, 1889. Collected by Morris M. Green. (Original number, 72.)

Measurements (taken in flesh).—Total length 203; tail vertebræ 96; hind foot 29; pencil 2. Ear from crown 17; from notch 21 (in dry skin).

General characters.—Size large; hind feet very long. Soles naked to heel. Ears large and broad; tail of medium length, nearly naked, showing the annuli distinctly; a distinct pectoral spot; whiskers very long and stiff.

Color.—Upper parts buffy-ochraceous, brightest on the sides, and mixed with black-tipped hairs along the back, forming a distinctly darker dorsal area. Under parts, including sides of nose in front of whiskers, creamy-white, with a distinct ochraceous spot on the breast. Tail concolor, slightly paler below than above.

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[*] *Bull. Am. Mus. Nat. Hist.*, N. Y., II, 3, 117. Separates issued June 7, 1889.

Cranial characters.—Skull very large and long (basilar length from occipital condyle to front of premaxillary 27.5; greatest length 30.5; length of molar series of teeth 4.2; interorbital breadth 4.6), its size alone being sufficient to distinguish it from any other species inhabiting the United States, not excepting *H. californicus*. The brain case is moderately arched above, and there is an indistinct supraorbital bead, which is continued posteriorly as a slight ridge along the parieto-squamosal suture. The rostral portion of the skull is long; the nasals long, narrow posteriorly, and extending backward considerably beyond the nasal branches of the premaxillaries. The incisive foramina reach the plane of the first molar; the palatal notch does not reach plane of last molar; the palatine foramina are situated opposite the second molar instead of on the plane of the interspace between the first and second. The zygomatic arches are very slender, broadest posteriorly, and dip down to the plane of the palate; in the dry skulls they curve in a little just in front of the widest part. The interparietal is narrower antero-posteriorly than in *H. leucopus* or *H. gossypinus*.

General remarks.—*Hesperomys macropus* requires comparison with but one species, *H. floridanus*. It differs from *floridanus* in color and in having larger ears (21 instead of 17.5 from notch), much longer hind feet (29 instead of 24), and larger and stiffer whiskers. No cranial comparisons can be made with *H. floridanus*, because the skull of the latter was not preserved.

I am indebted to Dr. J. A. Allen, curator of mammals and birds in the American Museum of Natural History, for the loan of the type specimen of *Hesperomys floridanus* for comparison with the present species.

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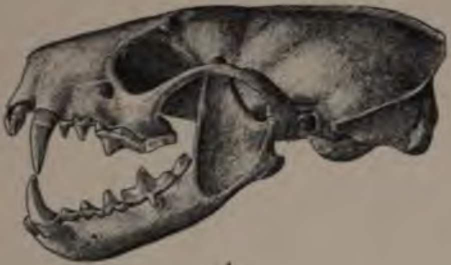
PLATE I.

(All natural size.)

1–3. *Spilogale phenax* (No. [illegible]) ♂ ad. Nicasio, California. ***Type.***
4–6. *Spilogale leucoparia* (No. [illegible]) ♂ ad. Mason, Texas.
(Fig. 6 shows the inflated mastoid capsules from behind.)



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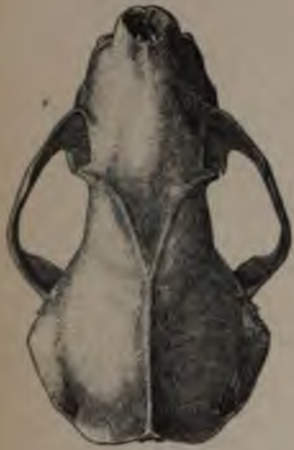

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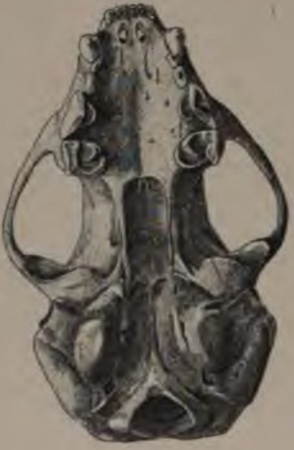

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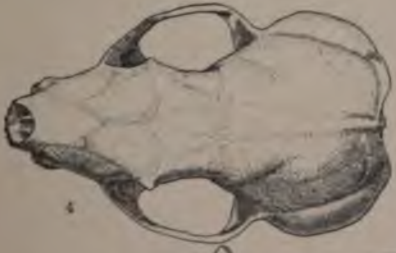

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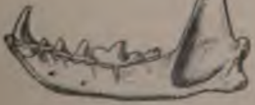

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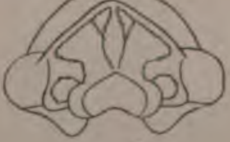


6

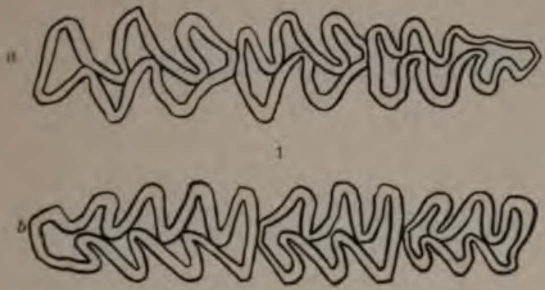
1-3. *Spilogale phenax* sp. nov.

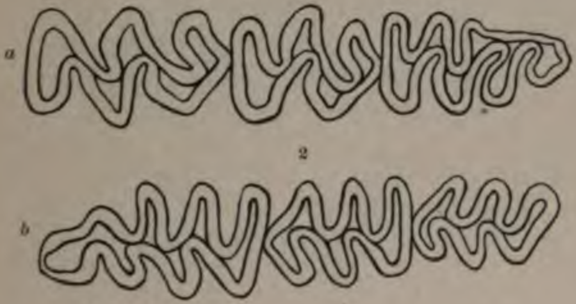
4-6. S. leucoparia sp. nov.

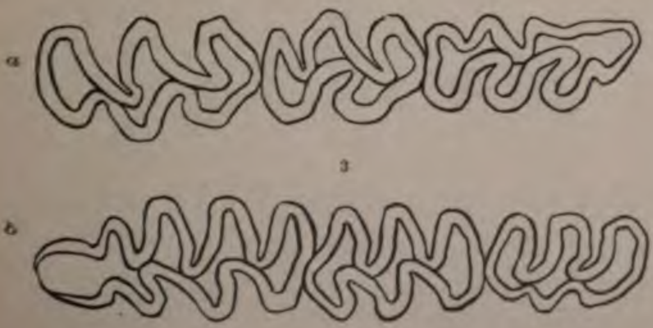
PLATE II.

(All magnified about 15 diameters.)

1. *Evotomys occidentalis* (No. [illegible]) ♂ ad. Aberdeen, Washington. *Type.*
   - *a.* Upper molar series.
   - *b.* Lower molar series.
2. *Evotomys californicus* (No. [illegible]) ad. Eureka, California. *Type.*
   - *a.* Upper molar series.
   - *b.* Lower molar series.
3. *Evotomys galei* (No. [illegible]) ♀ ad. Gold Hill, Colorado. *Type.*
   - *a.* Upper molar series.
   - *b.* Lower molar series.







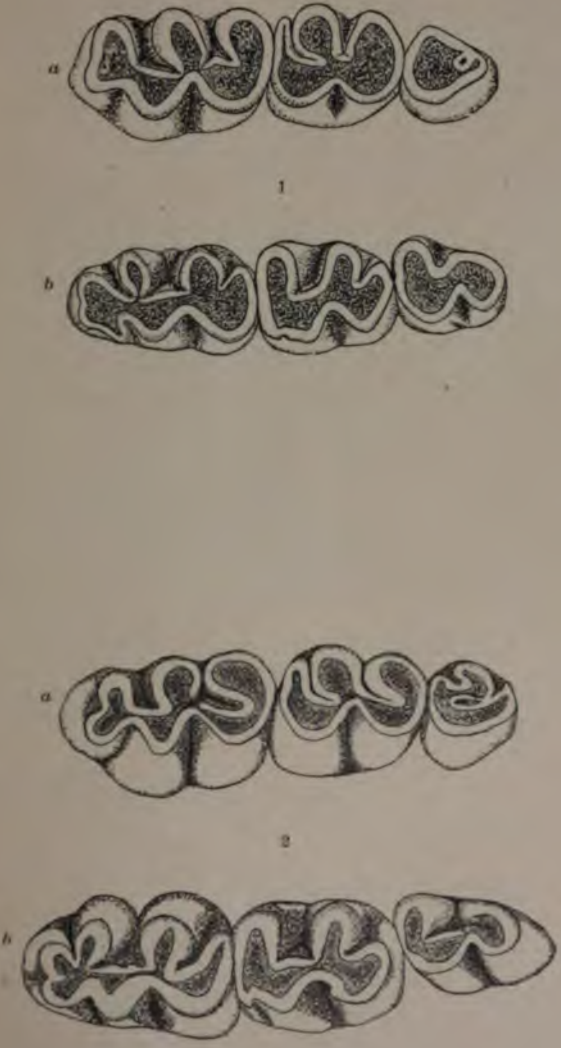
Evotomys occidentalis sp. nov. 2. *E. californicus* sp. nov. 3. E. *galei* sp. nov.

PLATE III.

(All magnified about 15 diameters.)

1 *Hesperomys macropus* (No. $\frac{23413}{16392}$) ♂ ad. Lake Worth, Florida. *Type.*
  - *a.* Left upper molar series.
  - *b.* Left lower molar series.

2. *Hesperomys macropus* (No. $\frac{23411}{16390}$) ♂. Lake Worth, Florida. (A younger specime
  - *a.* Left upper molar series.
  - *b.* Left lower molar series.



Hesperomys macropus sp. nov.: fig. 1, type; fig. 2, a younger specimen.

. DEPARTMENT OF AGRICULTURE

DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 5

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE

[Actual date of publication, July 30, 1891]

of a Biological Reconnaissance of south-central Idaho

1. General Results
2. Annotated List of Mammals, with descriptions of new species
3. Annotated List of Birds, with description of a new Owl

By Dr. C. Hart Merriam

4. Annotated List of Reptiles and Batrachians

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WASHINGTON
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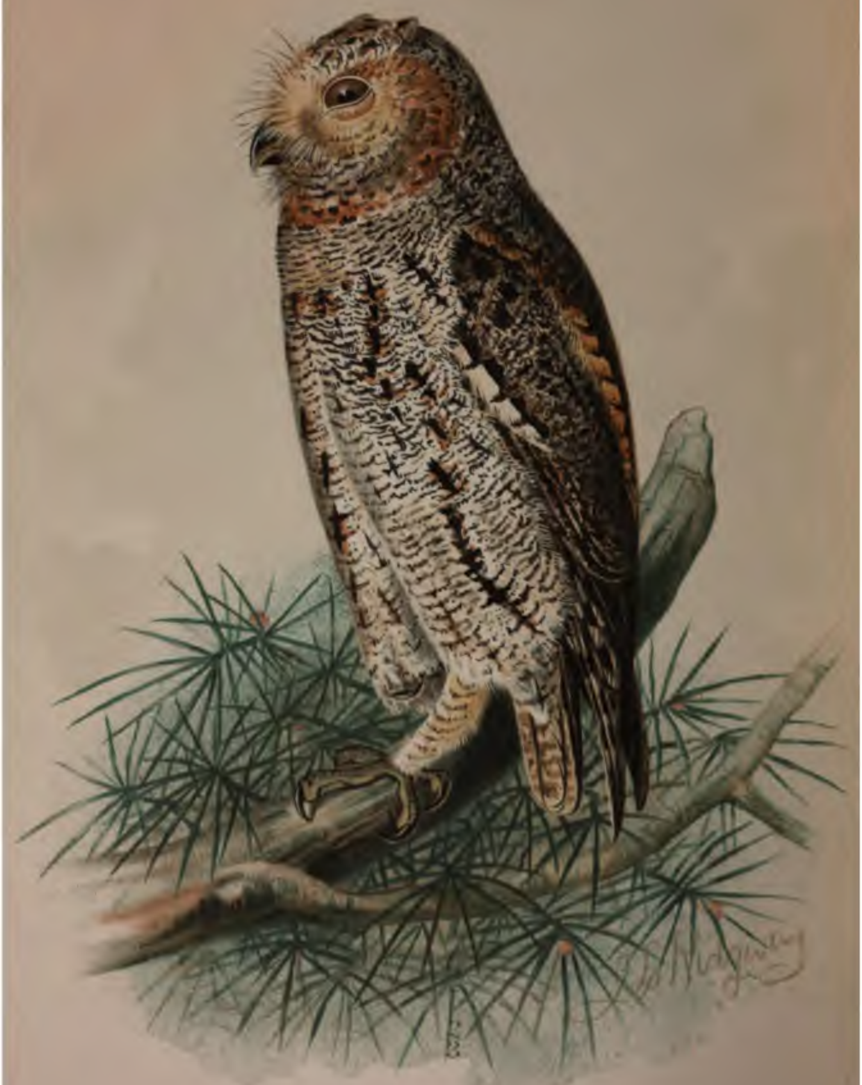
1891



DWARF SCREECH OWL.

(*Megascops flammeolus idahoensis* subsp. nov.)

A. Hoen & Co. Lithocaustic, Bal

. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

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GOVERNMENT PRINTING OFFICE
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U. S. DEPARTMENT OF AGRICULTURE,
March 16, 1891.

SIR: I have the honor to transmit herewith the manuscript of No. 5 of NORTH AMERICAN FAUNA. It contains the results of a Biological Reconnoissance of a part of Idaho, which I had the honor to conduct under your instructions during August, September, and October, 1890; and also descriptions of a new genus and several new species of North American mammals.

Respectfully,

C. HART MERRIAM,
Chief of Division of
Ornithology and Mammalogy.

HON. J. M. RUSK,
Secretary of Agriculture.

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No. 5. NORTH AMERICAN FAUNA. July, 1891.

RESULTS OF A BIOLOGICAL RECONNOISSANCE OF IDAHO, SOUTH OF LATITUDE 45° AND EAST OF THE THIRTY-EIGHTH MERIDIAN, MADE DURING THE SUMMER OF 1890, WITH ANNOTATED LISTS OF THE MAMMALS AND BIRDS, AND DESCRIPTIONS OF NEW SPECIES.

By Dr. C. HART MERRIAM.

PREFATORY NOTE.

The present paper consists of the results, hastily brought together, of a biological reconnoissance of Southern Idaho, made during the summer and fall of 1890, by the Division of Ornithology and Mammalogy of the U. S. Department of Agriculture.

The information heretofore available relating to the natural history of Idaho is so exceedingly scanty that all attempts to map the distribution of mammals or birds in the West, or to define the boundaries of faunal and floral zones, have encountered in this State an insuperable barrier, a veritable *terra incognita*.

It was for the purpose of breaking down this barrier that I asked permission of the Honorable Secretary and Assistant Secretary of Agriculture to undertake a biological reconnoissance of a part of Idaho during the summer of 1890. Permission having been granted, the work was done and the results are here briefly recorded. The number of birds known from the State is increased from 64 to 158; and the mammals from 15 to 67. One new owl and twelve new mammals were discovered and are here described. Much remains to be done, particularly in the northern part of the State, but enough has been accomplished to remove the obscurity previously investing the region and to furnish the key to the distribution of life in Idaho.

ITINERARY.

The expedition outfitted at Blackfoot, Idaho, July 8, 1890, crossed Snake River, and proceeded in a westerly direction over the sage plains and lava beds to Big Butte; thence northerly to Big Lost River, which was ascended to a point about 13 kilometers (8 miles) north of Arco; thence skirting the southern spur of the mountain range between Big and Little Lost River Valleys, the latter was ascended 24 kilometers (15 miles) and crossed to the mountains on the east side ('Lost River Mountains'); returning to the mouth of Little Lost River and crossing the sage plains in an easterly direction to the sinks of Big Lost River and Birch Creek, Birch Creek was ascended to its headwaters, and the low divide was crossed to Lemhi River, which was descended to its junction with Salmon River near Salmon City, the most northerly point reached.

Several side trips were made into the Salmon River Mountains from Birch Creek and Lemhi Valleys. There being no wagon pass over these mountains, it was necessary to return south by means of the same valleys and recross the sage plains to the mouth of Little Lost River. Little Lost River was then followed to its source and the divide between it and Pahsimeroi Valley was crossed.

A side trip was made to a cluster of high mountains at the sources of the Pahsimeroi on the south side of the east end of the valley of the same name. This valley was then descended to its junction with Salmon River, whence, turning south, the valley of Salmon River was ascended to Round or Challis Valley; thence, continuing southward through Antelope Valley and across the divide between Antelope Valley and Thousand Spring Valley to Big Lost River, Big Lost River was ascended to its very head, and the divide was crossed to Trail Creek, which was descended to its junction with Wood River near the town of Ketchum; Wood River was ascended to its headwaters, and the high divide, 2,750 meters (9,000 feet) in altitude, separating it from the head of Salmon River, was crossed, and Saw Tooth Lake and Mountains were visited.

Returning from the Saw Tooth Mountains, the route lay thence southerly, following in the main the course of Wood River (which, after it enters the sage plains, is called Big Wood or Malade) to a point 6½ kilometers (4 miles) northwest of the town of Shoshone; thence directly south across the lava beds and sage plains to Shoshone Falls in the great lava cañon of Snake River. The north side of this cañon was followed down to Payne or Lewis Ferry, where the river was crossed.

Ascending the bluffs on the south side, a southeasterly direction was taken to Castle Cañon and Devil Cañon; the latter being found impassable, the course was changed to south and southwest until intercepted by a long range of unmapped mountains, running from east-northeast to west-southwest from Salmon Falls River westerly across the headwaters of the Brunneau and extending as far at least as the Duck Valley Indian Reservation. The foot of this range was followed in a westerly direction to Three Creek, one of the headwaters of Brunneau River; thence turning southerly the range was crossed through a pass 2,600 meters (8,500 feet) in altitude between the high peaks locally known as Elk Mountain on the east and the Brunneau Mountains on the west; descending on the south side, Cañon Creek was followed to its junction with Salmon Creek, and the latter to its headwaters, whence a low and almost imperceptible divide was crossed to the headwaters of Mary River; Mary River was descended to Cold Spring, from which a southeasterly course was taken across the sage plains to Humboldt Wells, Nevada (on the Central Pacific Railroad), where the expedition disbanded October 17.

A detailed biological survey was not attempted, but a reconnoissance was made of about 51,800 myriares (20,000 square miles). Altitudes were determined by aneroids and must be regarded as approximate only. The aneroids were compared with standard cistern barometers at the signal station in Salt Lake City at both ends of the journey, and were checked by known elevations of several stations on the lines of the Utah Northern and Oregon Short Line railroads.

PERSONNEL.

The members of the expedition, in addition to myself, were: Vernon Bailey, chief field naturalist; Basil Hicks Dutcher and Clark P. Streator, assistants, with one man as cook and teamster. Mr. Bailey acted in charge from July 8 until August 23, when relieved by me. On the latter date Mr. Streator was sent to Oregon and Washington in order to ascertain the relations of the fauna of the Plains of the Columbia to that of the Snake Plains.

ACKNOWLEDGMENTS.

Capt. Charles E. Bendire, Curator of the Department of Oölogy in the U. S. National Museum, has had the kindness to read the manuscript of the bird chapter and has added several species from his own unpublished notes, as well as additional information concerning other species.

Mr. Robert Ridgway, Curator of the Department of Birds in the National Museum, has rendered important assistance by comparing certain subspecies with specimens in the Museum collection.

Dr. Leonhard Stejneger, Curator of the Department of Reptiles in the National Museum, has identified the reptiles and batrachians collected by the expedition, and has prepared an annotated list, which will be found at the end of the present report.

Dr. R. E. C. Stearns has identified the molluscs collected, and Mr. Walter Faxon the crayfish.

Most of the plants mentioned in the report were identified in the field by Mr. Bailey and myself. Others were brought back and have been determined by Mr. John M. Holzinger, AssistantBotanist U. S. Department of Agriculture, who also confirmed many of our field identifications.

The Museum of the Academy of Natural Sciences of Philadelphia

contains several types of mammals collected by Townsend in Idaho and Oregon more than half a century ago and described by Bachman in 1839.* Through the courtesy of the officers of the Academy these types have been sent me for examination and I have been able to compare them with specimens collected by us in the same region, thus establishing in several instances the identity of species previously in doubt or wrongly referred.

INTRODUCTION.

Very much less is known of the natural history of Idaho than of any other State or Territory in the Union; and no map of Idaho thus far published can claim even approximate accuracy.

In May, 1806, Lewis and Clark, returning from the Pacific to the headwaters of the Missouri, crossed the northern part of Idaho along the course of the Clearwater (about latitude 46° 30′). The narrative of their travels mentions the Deer, Elk, Moose, Bear, Bighorn, Burrowing Squirrel, [tree] Squirrel, Ducks, Pheasants, Buzzards, Hawks, Eagles, and Sand hill Cranes as observed in the region at present included within the boundaries of the State. Nearly 30 years later (in 1834) John K. Townsend made an overland journey from St. Louis to Oregon, in the course of which he crossed the Snake Plains and reached the southern spurs of the mountains which extend into the plains from the great mountain mass of central Idaho. His narrative mentions the Buffalo and other game, and a few of the smaller animals. From 1853 to 1857 several of the exploring parties of the Pacific Railroad Surveys passed through Idaho, but their reports contain nothing relating to the natural history of the region, except the occasional incidental mention of game. With these exceptions nothing was known to naturalists of the animal life of Idaho until 1872, when it was my privilege to accompany, in the capacity of naturalist, the U. S. Geological Survey of the Territories, under the command of the late Dr. F. V. Hayden. This expedition entered southeastern Idaho from Utah, passed up Malade Valley, and continued northward through eastern Idaho to Fort Hall and Market Lake (crossing Snake River at Eagle Rock); then, turning in an easterly direction, it visited Teton Basin, and, again bearing northward, followed Henry Fork of Snake River to Henry Lake, and thence passed into Montana and the Yellowstone National Park through Tahgee Pass. Returning in October, the expedition reëntered Idaho from Wyoming south of the Teton Range, revisited Fort Hall, and thence moved southward over essentially the same route as that taken on the northward march in June and July. During this expedition I collected in Idaho fifteen species of mammals and recorded sixty-four species of birds, all of which are enumerated with precise localities and dates in my official report.*

---

*Journal Acad. Nat. Sci., Phila., vol. VIII, 1839, pp. 57-74, 101-105.

In 1875 Mr. Robert Ridgway published a list † of five species of birds observed by him at 'City of Rocks,' in extreme southern Idaho, when attached to the Clarence King expedition as ornithologist.

In 1877 Capt. Charles E. Bendire published a paper on the '*Birds of Southeastern Oregon*,' in which eighteen species are mentioned that were observed by him in Idaho, mainly in the neighborhood of Fort Lapwai.‡

The scanty information above indicated comprises all the records heretofore published, so far as I am aware, relating to the mammals and birds of Idaho, save the incidental mention of a few species in notes on hunting and fishing that have appeared in 'Forest and Stream' and 'The American Field.'

GENERAL DESCRIPTION OF THE REGION TRAVERSED.

SNAKE PLAINS.

The Basin of Snake River in Idaho is an undulating, sage-covered plain stretching completely across the State in its widest part. It is crescentic in shape (with the convexity to the south) and measures about 600 kilometers (375 miles) in length by 120 to 160 kilometers (75 to 100 miles) in average breadth. Its boundaries on the north and east are everywhere sharply defined, consisting of rugged mountains rising more or less precipitously from the plain. In several places these mountains project southward in parallel ranges, like so many fingers, alternating with northward extensions of the plains, which occupy the valleys between them. Such valleys are those of Birch Creek and Lemhi River, Little Lost River, Big Lost River, and Malade or Big Wood River. On the south and west the Snake Plains are not so well defined, passing southward into Utah and Nevada between irregular ranges of mountains, and westward and northwestward into Oregon and Washington, where they are continuous with the Malheur Plains and Plains of the Columbia. The altitude of the basin along the course of Snake River is about 1,800 meters (nearly 6,000 feet) at the eastern end and less than 900 meters (3,000 feet) at the western, and its sides rise on the north and south to the altitude of 2,000 or even 2,150 meters

---

* Sixth Annual Report U. S. Geological Survey of the Territories, for 1872, 1873. Report on the Mammals and Birds of the Expedition, by C. Hart Merriam, pp. 661–715. I was then a lad of 16, and a boyish exaggeration of the unreliability of ocular evidence led me to the extreme course of omitting mention of every species of which specimens were not actually brought back to Washington. Nothing is said, therefore, of the deer and elk, with which our camp was often supplied, or of the turkey buzzard, white pelican, and other birds that were many times observed.

† Bull. Essex Inst., VII, 1, January, 1875, p. 24. Also, 4° Report U. S. Geological Expl. Fortieth Parallel, Clarence King in Charge, vol. IV, 1877, pp. 365, 366.

‡ Proc. Bost. Soc. Nat. Hist., vol. XIX, 1877, pp. 109–149.

(approximately 6,500 to 7,000 feet), forming a broad trough whose general direction is east and west.

The dominant feature of the Snake River Basin is sage plains—rolling, uninterrupted plains, rising so gradually from the bottom of the basin as to appear almost level, and stretching away in every direction as far as the eye can reach. The plains are everywhere arid. The few streams that reach Snake River by a surface course usually flow in lava channels and do not water the region on either side.

The surface rock which crops out here and there over the sage plains proper is dark basaltic lava. It appears in the form of irregular masses or beds, extensive lava flows, and in a few instances of broken-down craters, the largest of which, Big Butte, rises about 600 meters (2,000 feet) above the plain. Some of the cañons of Big Butte support a growth of Douglas fir and Murray pine. The lava flows present great diversity of form; elevated ridges of rough rock irregularly fissured and with jagged edges alternate with smooth, flat domes, suggesting giant bubbles; nearly level stretches marked by wavelets and ripples which bend and double, spread out as if just escaped from a seething, tumultuous caldron, while in many places the thick crust has fallen in, leaving deep pits of circular or elliptical outline, exposing the mouths of dark caverns that extend to unknown depths and furnish homes to owls and bats and a multitude of other nocturnal animals. This black lava or basalt overlies an earlier flow of porphyritic trachite, gray in color and much less firm in texture. The Great Shoshone Fall, commonly known as the 'Niagara of the West,' results from the cutting down of the river bed through the hard basalt to the softer trachite below.

In summer the heat is excessive, the thermometer frequently reaching 110° in the shade, while in winter the snow covers the ground, and icy winds sweep over the plain. The forms of life which inhabit the region, therefore, are such as can endure great heat during the season of reproductive activity, and can avoid the cold of winter by migration or hibernation; or if they remain active throughout the year they are hardy species, able to withstand great extremes of temperature and humidity.

Most of the rivers which flow down through the mountain valleys disappear on reaching the plains, and the greater part of the water which reaches Snake River does so by subterranean channels. Hundreds of springs pour their waters into the lava cañons of Snake River, usually at or near the bottom, and many of them are of great size. In winter their temperature is considerably higher than that of the river. Crayfish, identified by Mr. Walter Faxon as *Astacus gambellii* (Girard), abound in these warm springs and are much sought after by raccoons (*Procyon lotor ?*); and a small shell, identified by Dr. R. E. C. Stearns as *Fluminicola nuttalliana* Lea, is exceedingly abundant on stones in the same springs.

It is a common feature of the Snake Plains, as of many other arid parts of the West, that the rivers which do not sink cut for themselves deep channels with precipitous walls, their present beds being several hundred feet below the general surface level. Of this character are the grand lava cañons of Snake River itself and many of its tributaries, particularly on the south side. As a rule these cañons can not be seen until their very brinks are reached, and it is not often that they can be crossed on horseback.

The northern boundary of the Snake Plains is formed by the lofty mountains of central Idaho, and by that part of the main range of the Rocky Mountains which bends directly westward from the Yellowstone National Park. Three narrow parallel valleys penetrate the mountains of east-central Idaho in a northwesterly direction, carrying slender tongues of the sage plains all the way to Salmon River.

The soil of the Snake Plains, where not lava or sand, is generally alkaline, and the characteristic plants, in addition to the ever present sage (*Artemisia tridentata*), are such Sonoran species as *Atriplex confertifolia*, *Atriplex nuttallii*, *Artemisia pedatifida*, *Sarcobatus vermiculatus*, *Tetradymia canescens*, *Eurotia lanata*, *Eriogonum cernuum tenue*, several species of *Bigelovia*, a *Malvastrum*, and two or three kinds of cactus. *Artemisia trifida* and *Purshia tridentata* are common in the higher levels; and *Iva axillaris*, a saline species, was found at the sinks of Big Lost River.

The characteristic birds of the sage plains are the Sage Sparrow (*Amphispiza belli nevadensis*), Brewer's Sparrow (*Spizella breweri*), Sage Thrasher (*Oroscoptes montanus*), Burrowing Owl (*Speotyto cunicularia hypogæa*), Sage Hen (*Centrocercus urophasianus*), and Sharp-tailed Grouse (*Pediocætes phasianellus columbianus*), though the latter is rare in the area traversed. Ravens (*Corvus corax sinuatus*) and Magpies (*Pica pica hudsonica*) are common in places, and the Cañon Wren (*Catherpes conspersus*) was found near Shoshone Falls in the lava cañon of Snake River.

The most common diurnal mammals are the Great Basin or Sage Chipmunk (*Tamias minimus pictus*) and a small Spermophile (*Spermophilus townsendi*). Other equally characteristic species are the nocturnal Kangaroo Rat (*Dipodops ordii*), Pocket Mouse (*Perognathus olivaceus*), Grasshopper Mouse (*Onychomys leucogaster brevicaudus*). Four species of Rabbits, namely, the White-tailed and the Black-tailed Jack Rabbits (*Lepus campestris* and *L. texianus*), the Idaho Pigmy Rabbit (*Lepus idahoensis*), here described for the first time, and the Great Basin Cotton-tail (*Lepus sylvaticus nuttalli*) are common. Antelope roam over the plains in small herds, and Badgers and Coyotes are abundant. In the lava cañon of Snake River, near Shoshone Falls, the Plateau Lynx (*Lynx baileyi*), Raccoon (*Procyon lotor ?*), Little Striped Skunk (*Spilogale saxatilis ?*), Dusky Wood Rat (*Neotoma cinerea occidentalis*), and Cliff Mouse (*Hesperomys crinitus* sp. nov.) are common, and tracks of Porcupine (*Erethizon epixanthus*) were seen. Black-tailed Deer (*Cariacus macrotis*) inhabit the cañon in winter.

Rattlesnakes (*Crotalus lucifer*), Horned Toads (*Phrynosoma douglasii*), and small Lizards (*Sceloporus graciosus*) are common on the Snake Plains, and extend north through the principal sage-covered valleys. Two Bull Snakes, provisionally referred to *Pituophis catenifer* by Dr. Stejneger, were collected at Big Butte and Arco, and a single *Bascanion vetustus* at Big Butte.

Salmon and Sturgeon ascend Snake River to the Great Shoshone Fall. When we crossed the river at Lewis Ferry, October 12, we saw several large Sturgeon (*Acipenser transmontanus*) tied by the tails to stakes driven in the bank. One weighed fully 70 kilograms (150 pounds), and we were told by Mr. Lewis that he sometimes catches individuals weighing as much as 300 kilograms (660 pounds). He told us also that the fall run of Salmon reached his place about October 1, and that the fish that do not die go back in November. We met a number of Shoshone or Bannock Indians on their way to the river to spear Salmon. Some of them came all the way from the Lemhi Reservation.

A kind of Mole Cricket locally known as the Idaho Devil (*Stenopalmatus fasciatus*) is common on the Snake Plains in October. It is a large wingless insect with a great yellow head, powerful jaws, and a banded abdomen. I first saw it in eastern Idaho in October, 1872, and found it common from Shoshone Falls and Lewis Ferry to the headwaters of Brunneau River in October, 1890. It lives in burrows in the sage plains and its holes resemble those of the small Pocket Mice (*Perognathus olivaceus*) in being clean cut, going straight down at first, and having no mound at the opening. In crossing the plains during cold stormy weather the heads of these curious animals were often seen at the mouths of their burrows and many were met with walking about among the sagebrush. They walk much, with seeming dignity and deliberation, and their tracks may be seen in every direction. If two are held together they immediately bite off one another's legs and inflict other serious wounds. They bite a large straw in two at a single nip.

BIRCH CREEK AND LEMHI VALLEY.

The most easterly and longest of the series of parallel valleys which penetrate the mountains of east central Idaho is that of Birch Creek and Lemhi River. It is 160 kilometers (100 miles) in length by 6 or 8 kilometers (4 or 5 miles) in average breadth, and may be described as a single valley containing two streams which run in opposite directions, the divide between them being only a little over 2,130 meters (7,000 feet). Birch Creek sinks where it enters the Snake River Desert near the intersection of latitude 44° and longitude 113°; the Lemhi empties into Salmon River at Salmon City. The eastern boundary of Lemhi Valley is formed by the main chain of the Rocky Mountains (here occupying the boundary line between Idaho and Montana); and that of Birch Creek Valley by a southern offshoot or ridge of the same which terminates abruptly in a spur known as Rattlesnake Point. The western boundary of the whole valley is the Salmon River Mountains (the southern part of which is sometimes called the 'Lost River Mountains'). The Salmon River Mountains are much higher and more rugged than the Rocky Mountains, the peaks attaining an altitude of nearly 3,950 meters (13,000 feet) and being everywhere blotched with snow, while those of the latter rarely reach 3,350 meters (11,000 feet) and as a rule do not exceed timber line except near Salmon City.

The vegetation of the valley of Birch Creek and the Lemhi is much the same as that of the Snake Plains already described. Sage brush (*Artemisia tridentata*) covers the whole valley and reaches up over the foothills to the lower border of the coniferous forests which come down from the mountains. *Artemisia trifida* and *Bigelovia graveolens* are common in places along the higher parts of the valley and sides of the foothills. *Atriplex confertifolia*, *Sarcobatus vermiculatus*, and *Tetradymia canescens* occur in large patches in the lower levels up to about 1,950 meters (6,400 feet). This lower or Sonoran zone reaches northward to the lava dike at Johnston's Ranch, 16 kilometers (10 miles) south of Nicholia, and reappears about 48 kilometers (30 miles) further north, in the upper Lemhi Valley, whence it extends down to Salmon River. The intervening divide rises gradually to the height of a little more than 2,100 meters (7,000 feet) and is everywhere covered with sage.

Rattlesnakes (*Crotalus*) and Horned Toads (*Phrynosoma douglassii*) are common in Birch Creek and Lemhi Valley, though the Rattlesnakes seem to be confined to the Sonoran or lower levels. *Oroscoptes montanus* and *Amphispiza belli nevadensis* are common; and *Parus atricapillus septentrionalis* inhabits the willow thickets along the streams. *Lepus campestris*, *L. texianus*, *L. sylvaticus nuttalli*, and *L. idahoensis* range throughout the entire length of the valley, as does the Sage Chipmunk. Pocket Mice inhabit the gravel benches, but Kangaroo Rats extend only a short distance up the valley.

SALMON RIVER MOUNTAINS.

The above heading has been somewhat loosely applied to various masses of mountains in the neighborhood of the upper Salmon River in central Idaho. The use of the name is here restricted to the range universally known as the Salmon River Range, lying between the Lemhi Valley on the east and Salmon River and the Pahsimeroi on the west. Its southward continuation (between the valleys of Birch Creek and Little Lost River) is called 'Lost River Mountains' on the Land Office map, though there is no break in the range, either in continuity or direction, and I would suggest that the name 'Lost River Mountains' might be far more appropriately applied to the nameless range between Big and Little Lost Rivers. Between Birch Creek and Little Lost River the range is narrow and culminates in a single ridge of peaks, so that the profile is nearly the same from both valleys. Dome Peak is the highest point in the southern part of the range, and Needle Peak* only a little lower. Both are nearly 3,950 meters (13,000 feet) in altitude. The northern part of the Salmon River Mountains is very much broader than the southern and has no appearance of a range except from the valleys of the Lemhi and Pahsimeroi Rivers. Between these valleys is a great mass of high mountains culminating in a large number of irregularly disposed peaks, many of which exceed 3,650 meters (12,000 feet) in altitude. The geologic history of the region has not been studied, but it is evident that great and violent disturbances have taken place. Not only are mountains of granite, carboniferous limestone, and lava found in close proximity, but these three kinds of material, formed during widely remote periods of time, sometimes exist in actual contact in single peaks. Examples of such peaks may be found between the heads of Timber Creek and Eight-Mile Cañon. Looking west, northwest, and southwest from the summit of a high mountain north of Timber Creek nothing could be seen but a sea of lofty, rugged peaks heavily marbled with snow and separated by narrow gulches and deep cañons. The Pahsimeroi valley was not visible.

LIFE ZONES OF THE SALMON RIVER MOUNTAINS.

Arctic-Alpine Zone.—Many arctic-alpine plants grow upon the rocky summits of these mountains and five species were collected which were found by us on San Francisco Mountain, Arizona, in 1889,† namely, *Oxyria digyna*, *Sibbaldia procumbens*, *Geum rossii*,‡ *Polemonium confertum*, and *Silene acaulis*. Dense mats of a dwarf willow (*Salix reticulata*) only 50 to 75 millimeters (2 or 3 inches) in height and bearing quantities of beautiful white wool which the chipmunks were carrying off in large mouthfuls, abound below some of the snow banks; beds of wiry *Bryanthus taxifolius* border many of the springs, and *Draba alpina* occurs here and there among the rocks. To these should be added *Anemone baldensis*, collected by Mr. Bailey on Needle Peak, and *Actinella grandiflora*, collected on a peak near the head of Timber Creek. The birds found above timber line are *Leucosticte atrata* and *Anthus pensilvanicus*; probably the former belongs to this zone and the latter to the next. Mountain Goats (*Mazama montana*) and Sheep (*Ovis canadensis*) inhabit the summits in summer, but probably belong to the zone below. The upward ranges of the Pika (*Lagomys princeps*) and Marmot (*Arctomys* sp. ——?) extend far above timber line.

Sub-alpine or Timber-line Zone.—The altitude of timber line on the Salmon River Mountains varies from 3,050 to nearly 3,350 meters (10,000 to 11,000 feet), according to slope exposure. The trees which attain timber line and constitute the upper forest belt are *Pinus albicaulis* and

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* Needle Peak is carboniferous limestone. Fossils collected there by Mr. Bailey have been determined by Mr. Charles D. Walcott as belonging to the genus *Zaphrentis*.

† N. Am. Fauna No. 3, Sept. 1890, pp. 7–8.

‡ Mr. Holzinger determines this form to be the subspecies *humile*.

Abies subalpina, with an occasional *Picea engelmanni*. This belt may be divided into two zones—Sub-alpine and Hudsonian—as was done in treating of the life of San Francisco Mountain, Arizona. In the upper or dwarf timber zone the following small plants were found: *Arenaria biflora carnulosa*, *Arenaria congesta subcongesta*, *Aplopappus lyellii*, *Aplopappus suffruticosus*, *Chænactis douglassi alpina*, *Delphinium menziesii*, *Heuchera hallii*, *Pentstemon menziesii*, *Phleum alpinum*, *Potentilla nivea dissecta*, *Sedum debile*, *Senecio aureus compactus*, and *Solidago virgaurea alpina*. Several of these range above timber line. The Titlark (*Anthus pensilvanicus*) probably breeds in this zone. The only characteristic mammal obtained is a new species of Lemming Mouse (*Phenacomys orophilus*), though the Pika (*Lagomys princeps*) seems to find here its center of abundance. The Mountain Goat and Sheep (*Mazama montana* and *Ovis canadensis*) inhabit both the Sub-alpine and Arctic-alpine zones in summer, but I am inclined to believe that they really breed in the former, and therefore should be classed among the species properly belonging to this zone.

Hudsonian or Spruce Zone.—As stated in the previous section, the characteristic trees of the Hudsonian or upper timber belt of the Salmon River Mountains are *Pinus albicaulis* and *Abies subalpina*, sparingly mixed with *Picea engelmanni*. Another species, *Picea alba*, occurs with them and descends into the lower timber belt also. The altitude of the lower border of this zone on the eastern slope of the mountains is about 2,750 meters (9,000 feet). Among the small plants found in this zone on the Salmon River Mountains during the latter part of August were: *Astragalus kentrophyta*, *Calochortus gunnisoni*, *Calochortus nitidus*, *Erigeron compositus trifidus*, *Eriogonum ovalifolium*, *Gaultheria myrsinites*, *Heuchera parvifolia*, *Saxifraga bronchialis*, *Senecio canus*, and *Silene douglasii*. Among birds, Clark's Crow (*Picicorvus columbianus*), the Goshawk (*Accipiter atricapillus*), Pine Bullfinch (*Pinicola enucleator*), and Pink-sided Junco (*Junco annectens*) are characteristic species. *Phenacomys orophilus* sp. nov., is the only mammal found in this zone and not found below.

Canadian or Douglas Fir Zone.—On the east slope of the Salmon River Mountains the lower timber belt occupies the plane between 2,375 and 2,750 meters (7,800 and 9,000 feet) and consists chiefly of *Pseudotsuga douglasii* and *Pinus murrayana* mixed with a variable quantity of *Picea alba*. Small groves of *Populus tremuloides* are scattered here and there, usually occupying drier situations than those in which the conifers thrive best. Among the small plants of this zone are *Pyrola secunda*, *Rubus nutkanus*, *R. strigosus*, *Vaccinium microphyllum*, *Arctostaphylos uva ursi*, and at least three species of *Ribes*, one related to *R. floridum*, one to *R. cereum*, and one to *R. irriguum*. *Potentilla fruticosa* is abundant along the lower part of the zone, but is equally abundant in parts of the neutral zone below. Frogs (*Rana pretiosa*) were com-seen in the marshes; and a Garter Snake (*Eutaenia vagrans*) was collected.

Among the birds that breed in the Canadian Zone are: *Turdus audubonii*, *Regulus calendula*, *Parus gambeli*, *Sialia arctica*, *Sitta canadensis*, *Perisoreus canadensis capitalis*, *Cyanocitta stelleri annectens*, *Spinus pinus*, *Dendroica auduboni*, *Dendragapus obscurus richardsoni*, *Bonasa umbellus togata*, and *Bubo virginianus saturatus*. The characteristic mammals are *Neosorex*, *Evotomys*, and *Zapus*. Many others are common to this and the Hudsonian Zone, as the Bears, Wolverine, Marten, Fisher, Weasel, Shrews, Arvicolas, Richardson's Squirrel, Gray Ground Squirrel, Flying Squirrel, Chipmunk, Porcupine, Snow-shoe Rabbit, Moose, and Black-tailed Deer.

LITTLE LOST RIVER VALLEY.

The next valley west of and nearly parallel to Birch Creek is that of Little Lost River. It is about 70 kilometers (43 miles) in length by 13 to 16 kilometers (8 or 10 miles) in average breadth, and is walled in on both sides by high mountains—the Salmon River Mountains on the east and a nameless range on the west, the former separating it from Birch Creek Valley, the latter from Big Lost Valley.

The tongue of the Sonoran Zone which extends up the valley of Little Lost River from the Snake Plains reaches about 5 kilometers (3 miles) north of the ranch where the post-office of Clyde is now located, and is characterized by the presence of the species mentioned as occupying the same level in the valley of Birch Creek. The head of Little Lost Valley expands into a springy basin, into which a spur of the Salmon River Mountains projects from the north. Little Lost River heads northeast of this spur, while to the northwest a low pass (2,050 meters or 6,700 feet) connects directly with the head of the Pahsimeroi Valley. The pass is grassy and fed by many springs, most of which are surrounded by clumps of willows. *Artemisia trifida* is the prevailing sage here.

PAHSIMEROI VALLEY.

A small stream ("Ballberg Creek") trickles down the northwest side of the pass over the divide between the valley of Little Lost River and that of the Pahsimeroi. This stream joins the Pahsimeroi, which in turn empties into Salmon River. The axis of Pahsimeroi Valley is more nearly east and west than indicated on the Land Office and other maps (which represent it as nearly north and south). The valley is about 70 kilometers (43 miles) in length and is narrowly wedge-shaped, the base of the wedge being at the head of the valley, which is about 24 kilometers (15 miles) in width, while the apex (at the junction with Salmon River) is only 2 or 3 kilometers (1 or 2 miles) across. It is hemmed in on all sides by high mountains, the highest of which feed and protect [illegible]dwaters of the Pahsimeroi. Just west of this cluster of lofty peaks is a pass leading south to 'Thousand Spring' Valley, on Big Lost River.

A conspicuous band of timber stretches along the mountains on the north side of the valley, but does not come down within 300 meters (1,000 feet) of the plain; above it the bare rocky summits project from 300 to 600 meters (1,000 to 2,000 feet). About the middle of the valley on the south side (the northeast or cold slope) is a springy marsh covered with scattering Douglas fir and aspen. The bottom of the valley slopes rather steeply to the river, and the Sonoran zone runs up its full length to within about 5 kilometers (3 miles) of the divide, where it stops at an altitude of about 1,950 meters (6,400 feet). The altitude of the junction of the Pahsimeroi with the Salmon is about 1,400 meters (4,600 feet). The valley is covered with sage brush (*Artemisia tridentata*), mixed with grease woods (*Sarcobatus vermiculatus* and *Atriplex confertifolia*), with a sprinkling of *Tetradymia canescens* and *Opuntia*. Some of the fields of Atriplex are miles in extent, rivaling those near the sink of Little Lost River.* Pocket mice (*Perognathus olivaceus*) are common on the gravel benches; the Great Basin Chipmunk (*Tamias minimus pictus*) is abundant everywhere, and not less than four strongly marked species of rabbits inhabit the valley, namely, *Lepus texianus*, *L. campestris*, *L. sylvaticus nuttalli*, and the new *L. idahoensis*, the type of which was caught on the upper part of Pahsimeroi River, near the great bend. Still another species (*L. bairdi*) lives in the adjacent mountains. Coyotes (*Canis latrans*) are very common, and many were seen in the daytime sneaking along the edge of the willows, hunting for rabbits. Badgers abound throughout the valley, and in some places the large circular disks of pebbles which still remain to mark their former diggings are so numerous as to cover almost as much ground as the spaces between them. Sage Hens in large flocks were seen at the head of the valley; Magpies, Brewer's Blackbirds, Horned Larks, Meadowlarks, Sparrow Hawks, and Vesper Sparrows were common; a few Turkey Vultures and Mourning Doves were seen, and Green-winged Teal, Marsh Hawks, and Kingfishers were common along the river. A single White-rumped Shrike was observed.

At the time of our visit, September 12 to 18, the lower part of the Pahsimeroi River, which averages about 15 meters (50 feet) in width and two-thirds of a meter (2 feet) in depth, was full of large Salmon (probably *Oncorhynchus chouicha*), still working upstream. Many of them were bruised, others were in excellent condition, and I never saw a finer

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* In descending the Pahsimeroi Valley we passed through a tract of *Atriplex confertifolia* at least 13 kilometers (8 miles) in length. Both this species and *Tetradymia canescens* are excellent examples of 'social' plants, each covering large areas, often hundreds or even thousands of acres in extent, to the exclusion of most other forms of vegetation, and ending abruptly with a sharp line of demarcation. In other places they associate together and are mixed with sage-brush (*Artemisia tridentata*) and *Sarcobatus vermiculatus*. The latter species also is a 'social' plant, but was not observed in such large patches.

Salmon than one we took for our own use. It weighed about 18 kilograms (40 pounds) and measured 1,170^{mm} (46 inches) in length by 610^{mm} (2 feet) in girth; its flesh was hard and delicious.

PAHSIMEROI MOUNTAINS.

This name is here applied for the first time to a group of lofty, rugged, snow-marbled peaks, arranged in the form of a double or triple amphitheater, surrounding the sources of the Pahsimeroi River, and about 32 kilometers (20 miles) south of the pass between the Little Lost and Pahsimeroi Valleys. On the south these same mountains face 'Thousand Spring Valley,' which is an offshoot from Big Lost River Valley. There are two main amphitheaters, facing each other obliquely and feeding the two principal heads of the Pahsimeroi—an east and a west, of which the latter is the larger. The two forks unite to form the Pahsimeroi proper, which flows north about 19 kilometers (12 miles) through a nearly straight, terraced cañon, so deep that the trees bordering the river do not reach halfway to the top, and then bends abruptly to the west, soon taking the course of the main valley. The west fork forks again, and successions of beautiful cascades adorn both branches. On one of these I found a family of Water Ouzels and discovered their large nest of moss in a niche in the rock. The level stretches along both forks are bordered by broad thickets of willows, which shelter many Snowshoe Rabbits; and the woody *Potentilla fruticosa* grows profusely along the lower border of the timber, where it is associated with *Frasera speciosa*. The bleak rocky summits of the mountains, the home of many Mountain Sheep, rise nearly 900 meters (3,000 feet) above timber line, and their precipitous north slopes are marked by enormous banks of perpetual snow. Lower down are dark coniferous forests abounding in Elk and Black-tailed Deer; and below these still are thickets of mountain mahogany (*Cercocarpus ledifolius*). The prevailing timber is *Pseudotsuga douglasii*, *Pinus murrayana*, and *Picea alba*, with *Pinus albicaulis*, and *Abies subalpina* occupying the higher elevations and reaching timber line. *Pinus flexilis* grows sparingly in some places, and *Populus tremuloides* occurs with the Douglas fir below. These forests fairly swarmed with Squirrels (*Sciurus richardsoni*) and Chipmunks (*Tamias quadrivittatus amœnus*) at the time of our visit (September 13–16). Beaver were common in the streams, and small herds of Antelope grazed over the non-forested hills. Bleaching skulls and skeletons of the Buffalo attested the former presence of this nearly extinct species. Burrows of Spermophiles and Marmots (*Arctomys*) were found, but the inhabitants had gone into winter quarters. Colonies of Pikas (*Lagomys princeps*) dwelt in the rock slides high up, and two new species of *Arvicola* were abundant in the springy meadows at and below timber line—one a huge species (*A. macropus*), the largest yet found in America except *Arvicola* (*Neofiber*) *alleni* of Florida; the other a very small species (*A. nanus*). A single Shrew was secured (*Sorex vagrans similis*). Blue

Grouse (*Dendragapus obscurus richardsoni*) were common in the forests and willow thickets; Clark's Crows (*Picicorvus columbianus*) and Townsend's Solitaire (*Myadestes townsendi*) were numerous in the higher levels, and both species of *Regulus* were observed. *Zonotrichia leucophrys* and *Melospiza lincolni* were killed in the willow thickets, and several Kingfishers were seen along the streams.

ROUND OR CHALLIS VALLEY.

Round or Challis Valley occupies both sides of Salmon River, and is about 13 kilometers (8 miles) long and 9 kilometers (5½ miles) broad. It is surrounded by low, rounded mountains, and is continuous to the northward with the narrow valley of Salmon River, and to the southeast with Antelope Valley. Late as was the time of our visit (September 18–21) we found a beautiful *Malvastrum* in flower near the river. Other characteristic Sonoran plants growing in great abundance in the valley are *Atriplex confertifolia*, *Sarcobatus vermiculatus*, and *Eurotia lanata*. Sage brush (*Artemisia tridentata*) is the prevailing plant at all levels. Kangaroo Rats and Pocket Mice are common, and both White and Black Tailed Jack Rabbits were seen. Muskrats and Ducks abound in the sloughs of the river; Wood Rats inhabit the cliffs on its east bank, White-footed Mice swarm in the willow thickets, and two kinds of Arvicolas are common in the grassy bottoms. Several Fishhawks and Kingfishers, many Magpies and Crows, a few Turkey Buzzards, a Great Blue Heron, a Jack Snipe, and a Gull were noted along the river; and large flocks of Titlarks abounded throughout the valley.

Several Garter Snakes (*Eutainia vagrans*) were found in the water in small, cold streams emptying into Salmon River a few miles north of Round Valley.

ANTELOPE VALLEY.

Antelope Valley (altitude about 1,850 meters or 6,100 feet) is about 10 kilometers (6 miles) long by 6 kilometers (3½ miles) broad, with the longest axis nearly north and south, and is continuous with Challis Valley on the north. Its eastern boundary is a high rocky range rising sharply from the plain and culminating in a single lofty ridge, not broken into separate peaks. It is an ideal 'mountain wall.' On the west the mountains are rounded and grassy, and are not so high. The bottom of the valley is sandy, and in it were noticed numerous burrows of Kangaroo Rats. *Atriplex confertifolia* and *Eurotia lanata* were conspicuous plants. Antelope Valley is separated from the valley of Big Lost River by a divide about 2,225 meters (7,300 feet) in altitude at the lowest point.

BIG LOST RIVER VALLEY.

The valley of Big Lost River is the largest of the three parallel valleys which penetrate the mountains of east-central Idaho from the sage plains of Snake River, and the river from which it takes its name is larger than the other two together. The valley is about 80 kilometers (50 miles) long and ends in a broad, triangular basin, with the river flowing along its south side and bordered by trees. The west side of this basin is crescent-shaped, the south horn of the crescent curving westward to the narrow valley of the upper part of the river, the north arm containing 'Thousand Spring Valley' and Willow Creek, and connecting by a pass 2,225 meters (7,300 feet) in altitude with Antelope Valley, and thence with Salmon River at Round or Challis Valley. The Sonoran zone occupies the main part of Big Lost Valley and of Antelope and Challis Valleys. Above 'Thousand Spring Valley' Big Lost River flows through a narrow valley or cañon, with mountains close by on both sides. Through the gaps on the south side rugged, snow-capped peaks appear. A large branch rises in these mountains. The headwaters of Big Lost River are separated from those of Trail Creek by a divide more than 2,440 meters (8,000 feet) in altitude at the lowest pass and with much snow in the cañons on both sides. The divide is covered by a forest of *Pinus murrayana*, with a few scattering trees of *Pseudotsuga douglasii* and *Picea alba*. Here we found the Moose Bird or Canada Jay, Clark's Crows, and many Richardson's Squirrels and Snowshoe Rabbits. In the rock slides were colonies of Pikas (*Lagomys*) and Gray Ground Squirrels (*Tamias cinerascens*).

The descent to the valley of Trail Creek is precipitous. Though the date of our crossing was near the end of the hot season (September 23), several snowdrifts 9 meters (30 feet) in depth were found, and three extensive snow-bridges were observed. These are the remains of huge avalanches, and hundreds of large trees were seen which had been snapped off or torn up by the roots and carried into the bottoms of the valleys. Trail Creek Valley contains the largest groves of poplars met with during the season.

VALLEY OF THE BIG WOOD RIVER.

Wood River rises in high mountains only a few miles distant from the ultimate sources of Salmon River, from which it is separated by a divide, the lowest pass in which is 2,750 meters (9,000 feet) in altitude. For many miles it flows through a narrow valley with high mountains on both sides, and with Douglas fir and Murray pine growing down to the lowest levels. It was here that a colony of *Lagomys* was found in a rock slide as low as 2,250 meters (7,400 feet), and *Sorex*, *Neosorex*, and *Arvicola* were caught in the marshy bottoms. A little lower down the river is bordered with groves of aspens (*Populus tremuloides*) and cottonwoods (*P. balsamifera*) alternating with extended stretches of willow thickets. On reaching the neighborhood of the town of Hailey the valley begins to widen and the mountains become lower. A few miles below it spreads out into the sage plains, the mountains disappear altogether, and the river changes its name to Big Wood or Malade.

This river, and Little Wood which finally empties into it, are the first streams west of Henry Fork, 240 kilometers (150 miles) distant, which succeed in crossing the arid Snake Plains from the north and actually reach Snake River.

VALLEY AT THE HEAD OF SALMON RIVER.

The valley at the head of Salmon River is a sage-covered basin about 12 kilometers (7½ miles) in width between the Saw Tooth Mountains on the west and a nameless range on the east. It extends in a north and south direction from the sources of Salmon River in northern Alturas County to Stanley Basin in western Custer County, and is about 2,135 meters (7,000 feet) in altitude. The Sage Chipmunk (*Tamias minimus pictus*) is common in the valley, and Sage Hens (*Centrocercus urophasianus*), Horned Larks (*Otocoris alpestris arenicola*), Titlarks (*Anthus pensilvanicus*), and Meadowlarks (*Sturnella neglecta*) were seen there early in October. The head of Salmon River is separated from the headwaters of Wood River by a divide 2,745 meters (9,000 feet) in altitude at its lowest pass. Forests of Murray pine and Douglas fir come down to the level of the valley on the west side.

SAW TOOTH MOUNTAINS.

The Saw Tooth Mountains form the western boundary of the valley of the upper part of Salmon River. They are covered with coniferous forests from the very base on the east side to timber line. The principal trees are Douglas fir and Murray pine below, and *Pinus albicaulis* and *Abies subalpina* above, mixed with *Picea engelmanni* and *P. alba*. The peaks are rocky and jagged, but not so high as those of the Salmon River and Pahsimeroi Mountains. At the east foot of the range are several lakes, known collectively as the 'Red Fish Lakes' because inhabited by a bright red Salmon called Nerka (*Oncorhynchus nerka*). One of these, Saw Tooth or Alturas Lake, is about 5 kilometers (3 miles) in length by 2 (a little over a mile) in breadth, and is surrounded by forests of Murray pine with here and there a little Douglas fir. It lies between two spurs of the mountains and is about 2,200 meters (7,200 feet) in altitude. There is a fine sand beach at the head (west end) of the lake, bordered by a narrow strip of Murray pine, behind which is an extensive willow marsh dotted with clumps of pine and fir.

The narrow valleys and cañons west of the lake were almost impassable at the time of our visit because of the fallen timber brought down by avalanches during the heavy snows of the previous winter (winter of 1889–'90). As a rule each avalanche takes all the trees in its path, tearing them up by the roots on the higher mountain sides and snapping off their trunks where the snow is drifted in the hollows, carrying them down into the valleys below and piling them up in wild confusion. In several instances these snow slides not only swept completely across the bottoms of the valleys, but rushed up the opposite sides to a height of 200 meters (650 feet) and deposited there the ruins of the forests they had destroyed. Miles and miles of the torn and shattered trunks of trees fill the valleys and cañons, and ages may pass before the barren mountain sides regain a forest covering.

Along the outlet of the lake are several large flats or parks, some of which are covered with grass, others with sage brush. Near the lake a blue gentian (*Gentiana affinis*) was in flower, and *Potentilla fruticosa* was abundant (a few still in flower). *Rubus nutkanus* was common in the forest, as were two species of currant (*Ribes*), one having bright red berries; and service berries (*Amelanchier alnifolia*), some of exceptionally large size, were found in places. High up in the mountains near the snow were large beds of the handsome purple *Pentstemon kingii* in full bloom; and also beds of a yellow *Eriogonum*, and a few stems of a beautiful bright red *Gilia* related to *G. aggregata*. Frogs (*Rana pretiosa*) were common in the marshes.

Lynxes, Foxes, Badgers, Black-tailed Deer, Bears, Wolverines, Fishers, Martens, Weasels, Porcupines, Snow-shoe Rabbits, and Flying Squirrels inhabit the forests about the lake; Otters, Mink, and Muskrats live along the shores, Beavers in the mountain streams; Red Squirrels and Chipmunks were extraordinarily abundant everywhere, and Pocket Gophers were common in the parks. Numerous burrows of Spermophiles and the Gray Ground Squirrel were observed, but the season was so late that the animals had gone into winter quarters. The marshes and grassy places are inhabited by a water shrew (*Neosorex palustris*), two small shrews (*Sorex idahoensis* and *S. dobsoni*, both new), and two new species of *Arvicola* (*A. mordax* and *A. macropus*). White-footed Mice (*Hesperomys leucopus*) abound in all sorts of places; a new species of Red-backed Mouse (*Evotomys idahoensis*) lives under rotten logs in the woods, and a new Lemming Mouse (*Phenacomys orophilus*) makes its home high up in the mountains. Elk roam through the most inaccessible parts of the forests, and are said to be common about the sources of the Payette. Mountain Goats are common and Sheep less common on the summits of the range, where Pikas (*Lagomys princeps*) inhabit the rock slides, and Marmots (*Arctomys sp. ?*) have their dens.

The following meat-eating birds were caught in traps set for Martens (baited with chipmunks, squirrels, and birds): One Goshawk (*Accipiter atricapillus*), one Great Horned Owl (*Bubo virginianus saturatus*), three Clark's Crows (*Picicorvus columbianus*), six Rocky Mountain Jays (*Perisoreus canadensis capitalis*), and four Magpies (*Pica pica hudsonica*). We were surprised to find the latter species remaining about camp after the ground was covered with snow. A flock of Robins was seen several times in the pines at the head of the lake, but left with the appearance of snow. An adult Bald Eagle was seen at the same place October 1. Great Horned Owls were heard hooting every night, and one was caught in a steel trap baited with the head and wings of a duck. Its stomach contained two Pocket Gophers, one White-footed Mouse, one *Arvicola*, and one new species of Lemming Mouse (*Phenacomys orophilus*).

LIST OF BIRDS NOTED IN THE SAW TOOTH MOUNTAINS, AT OR NEAR SAW TOOTH OR ALTURAS LAKE, SEPTEMBER 25 TO OCTOBER 4, 1890.

Colymbus auritus. Horned Grebe.

Abundant on the lake; several killed; at least a hundred seen in one day.

Urinator imber. Loon.

One seen on the lake near camp October 2.

Merganser serrator. Red-breasted Merganser.

Several small flocks seen on the lake.

Anas boschas. Mallard.

Common in flocks on the lake; six killed.

Anas americana. Baldpate.

Two shot on the lake.

Anas discors. Blue winged Teal.

Two shot on the lake.

Aythya americana. Redhead.

One shot on the lake.

Grus mexicana. Sandhill Crane.

Several Sandhill Cranes were heard on the big meadow below the lake.

Fulica americana. Coot; Mud-hen.

Two shot on the lake.

Dendragapus obscurus richardsoni. Richardson's Grouse.

A flock of about forty seen.

Dendragapus franklini. Franklin's Grouse.

Said to be tolerably common.

Circus hudsonius. Marsh Hawk.

One seen near the lake.

Accipiter velox. Sharp-shinned Hawk.

One seen.

Accipiter atricapillus. Goshawk.

An adult male shot and an immature bird caught in a marten trap.

Haliæetus leucocephalus. Bald Eagle.

A fine adult was seen near camp at the head of the lake October 1.

Pandion carolinensis. Fish Hawk; Osprey.

Seen several times before the snow storm.

Bubo virginianus saturatus. Dusky Horned Owl.

One caught in trap and others heard.

Ceryle alcyon. Kingfisher.

Common.

Dryobates villosus hyloscopus. Cabanis's Woodpecker.

Common at foot of lake.

Picoides arcticus. Arctic Three-toed Woodpecker.

One shot at foot of lake.

Colaptes cafer. Red-shafted Flicker.

Several seen.

Pica pica hudsonica. Magpie.

Common about the head of the lake. Four caught in marten trap

Cyanocitta stelleri annectens. Black-headed Jay.

Three seen, of which two were shot.

Perisoreus canadensis capitalis. Rocky Mountain Jay.

Common. Half a dozen caught in marten traps.

Corvus americanus. Crow.

Several seen about the head of the lake before the storm.

Picicorvus columbianus. Clark's Crow.

Common in the mountains. Three caught in marten traps.

Spinus pinus. Pine Siskin.

Heard several times.

Zonotrichia intermedia. Intermediate Sparrow.

Abundant in bushes everywhere.

Spizella socialis arizonæ. Western Chipping Sparrow.

One shot at head of lake.

Junco hyemalis shufeldti. Rocky Mountain Junco.

Common.

Junco annectens. Pink-sided Junco.

Common.

Melospiza lincolni. Lincoln's Sparrow.

One caught in an *Arvicola* trap.

Dendroica auduboni. Audubon's Warbler.

Several seen.

Anthus pensilvanicus. Titlark.

A few seen. Common in the sage parks below the lake.

Cinclus mexicanus. Ouzel; Dipper.

Two seen—one running along the sand beach at head of lake.

Troglodytes hiemalis. Winter Wren.

One seen.

Certhia familiaris montana. Rocky Mountain Creeper.

One shot and several seen.

Sitta carolinensis aculeata. Slender-billed Nuthatch.

One seen.

Parus gambeli. Mountain Chickadee.

Common.

Regulus satrapa. Golden-crowned Kinglet.

Seen several times.

Regulus calendula. Ruby-crowned Kinglet.

A few seen.

Merula migratoria propinqua. Western Robin.

A flock staid about the head of the lake before the storm.

Sialia arctica. Mountain Bluebird.

Small flocks seen at foot of lake.

BRUNNEAU MOUNTAINS.

This name is applied to an unmapped* range of mountains on or near the boundary between Owyhee County, Idaho, and Elko County, Nevada. The general course of the range is ENE. by WSW. On the Idaho side it rises abruptly from the plain (base level about 1,850 meters, or 6,000 feet), and its highest peaks, which are near the headwaters of the Brunneau River, attain an altitude of 3,350 to 3,650 meters (11,000 or 12,000 feet). The altitude of the lowest pass is about 2,600 meters (8,500 feet). Many deep cañons come out of these mountains and reach far into the Snake Plains. At the time of our visit the range was entirely covered with snow. Ranchmen living along the Brunneau River know the western part of these mountains as the Brunneau Mountains. Since the eastern part has no name, the whole range is here called the Brunneau Range. The mountains are chiefly bare, particularly on the Nevada side, though there are some extensive tracts of coniferous forests and many groves of aspens, below which is considerable mountain mahogany (*Cercocarpus ledifolius*). The higher parts of the divide are dotted with large patches of *Ceanothus velutinus*, an evergreen shrub, whose bright, deep green foliage contrasts handsomely with the snow-covered mountain sides. Elk are said to inhabit these mountains, and we found tracks of Deer, Porcupine, and Weasel on the snow in a grove of *Abies subalpina* on the north side of the pass. Such a storm was raging when we crossed the mountains (October 14) that we saw no birds, and had great difficulty in finding the way.

LIFE ZONES OF IDAHO.

It is with considerable reluctance that an attempt is here made to define the Life Zones of Idaho, even in a general way. The fact that I did not reach the field until the latter part of August, when most of the migratory birds were well on the way south and most of the plants had ceased flowering—if indeed they had not disappeared altogether—coupled with the circumstance that no means were at hand for precise determination of altitudes, make the task exceedingly difficult, and it is still further complicated by the effects of slope exposure and aridity. The limitations of the zones here announced, therefore, and the assignment of species must be regarded as provisional only. The zones recognized are the same as those of San Francisco Mountain, Arizona (defined in North America Fauna, No. 3, pp. 7–13), namely: Arctic Alpine; Sub-Alpine or Timber line; (Central) Hudsonian or Spruce; (Central) Canadian or Douglas fir; Neutral or Transition; and Upper Sonoran. Of these, the first four belong to the *Boreal Province*, which in Idaho consists of a mixture of species characteristic of the Rocky Mountain and Pacific arms or divisions.

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*Bonneville's map of 1837 shows this range as part of a range supposed to reach from Wyoming to California.

ARCTIC-ALPINE ZONE.

(Above timber line.)

This zone extends from the upper limit of tree growth to the summits of the highest peaks, and is characterized by the presence of small but often showy-flowered Arctic plants. The following species were obtained notwithstanding the lateness of the season:

Actinella grandiflora.
Anemone baldensis.
Bryanthus taxifolius.
Carex festiva.
Delphinium andersoni.
Draba alpina.
Geum rossii humile.
Oxyria digyna.
Polemonium confertum.
Salix reticulata.
Sibbaldia procumbens.
Silene acaulis.

The breeding season of birds was over before the mountains were reached, but young and old Rosy Finches (*Leucosticte atrata*) were common in small flocks above timber line. The mammals known to inhabit this zone are *Lagomys princeps*, *Arctomys*, *sp.*—?, *Mazama montana*, and *Ovis canadensis*. All of them are found also in the zone below, and consequently are not characteristic. The altitude of timber line varies from about 3,050 meters (10,000 feet) to nearly 3,350 meters (11,000 feet) according to slope-exposure.

SUB-ALPINE OR TIMBER-LINE ZONE.

(Approximate altitude 3,050 to 3,350 meters, or 10,000 to 11,000 feet).

This zone comprises the belt of *stunted trees* extending from the uppermost limit of tree growth, however depauperate, to the upper limit of full grown, perfect trees; and I am inclined to give it greater vertical range than in my report on San Francisco Mountain in which it was first defined. The dwarf trees which grow in this zone in central Idaho are *Abies subalpina* and *Pinus albicaulis*, with an occasional *Picea engelmanni*. The smaller plants observed are:

Agrostis varians.
Arenaria biflora carnulosa.
Arenaria congesta subcongesta.
Aplopappus lyellii.
Aplopappus suffruticosus.
Aster kingii.
Chænactis douglassi alpina.
Delphinium menziesii.
Heuchera hallii.
Juniperus communis.
Pentstemon menziesii.
Phleum alpinum.
Potentilla nivea dissecta.
Sedum debile.
Selaginella rupestris.
Senecio aureus compactus.
Silene douglassi.
Solidago virgaurea alpina.

Titlarks (*Anthus pensilvanicus*) were common at the upper part of this zone and in the zone above. The Mountain Sheep (*Ovis canadensis*) and Mountain Goat (*Mazama montana*) probably breed here. The most characteristic small mammals are *Phenacomys orophilus*, *Lagomys princeps*, and *Arctomys*, sp.—? Other species that reach timber line from below are *Tamias cinerascens*, *Tamias quadrivittatus amœnus*, *Arvicola macropus*, *Neotoma cinerea* (not normally?), *Hesperomys leucopus*, *Erethizon epixanthus*, and a weasel provisionally referred to *Putorius longicaudus*.

(CENTRAL) HUDSONIAN OR SPRUCE ZONE.

(Approximate altitude 2,750 to 3,050 meters, or 9,000 to 10,000 feet.)

This zone extends from the lower limit of the Timber-line Zone to the upper border of the Canadian or Douglas fir Zone. Its characteristic trees are *Pinus albicaulis* and *Abies subalpina* with here and there *Picea engelmanni*. Some of the smaller plants are:

Astragalus kentrophyta.
Calochortus gunnisoni.
Calochortus nitidus.
Erigeron compositus trifidus.
Eriogonum ovalifolium.
Spiræa (Eriogynia) cæspitosa.
Gaultheria myrsinites.
Heuchera parvifolia.
Pentstemon kingii.
Saxifraga bronchialis.
Senecio canus.

Among the birds that breed in the Hudsonian Zone in Idaho are: *Accipiter atricapillus*, *Bubo virginianus saturatus*, *Coccothraustes vespertina montana*, *Junco annectens* (?), *Myadestes townsendi*, *Picicorvus columbianus*, *Perisoreus canadensis capitalis*, and *Regulus calendula.*

Among mammals, *Phenacomys orophilus* and *Lagomys princeps* apparently find their normal lower limit here. The mammals which are common to this zone and the next below will be mentioned under the latter.

(CENTRAL) CANADIAN OR DOUGLAS FIR ZONE.

(Approximate altitude 2,300 to 2,750 meters or 7,700 to 9,000 feet.)

This zone extends from the lower border of the Hudsonian to the upper border of the Neutral Zone, which latter, in Idaho, consists mainly of sage brush. The characteristic trees of the Canadian Zone are *Pseudotsuga douglasii* and *Pinus murrayana*, more or less mixed with *Picea alba* and *Populus tremuloides.* The low altitude reached by some of these trees in springy bogs and along the courses of streams must not be taken into account in fixing the lower boundary of this zone, for the reason that the water in these mountain springs and streams is very cold, often coming but a short distance from melting snowbanks, consequently lowering the temperature of the soil in which the trees are rooted and (by surface evaporation) of the atmosphere to which their foliage is exposed. Among the smaller plants of this zone are:

Arctostaphylos uva-ursi.
Potentilla fruticosa.
Pyrola secunda.
Rubus nutkanus.
Rubus strigosus.
Ribes cereum.
Ribes irriguum.
Ribes floridum.
Vaccinium microphyllum.
Frasera speciosa.

Among the characteristic birds are:

Turdus auduboni.
Parus gambeli.
Sialia arctica.
Sitta canadensis.
Cyanocitta stelleri annectens.
Spinus pinus.
Dendroica auduboni.
Dendragapus obscurus richardsoni.
Dendragapus franklini.
Bonasa umbellus togata.
Bubo virginianus saturatus.

Many mammals inhabit the Douglas fir Zone in Idaho. Those supposed to be characteristic are *Evotomys idahoensis*, *Arvicola mordax*, *Zapus hudsonius*, *Neosorex palustris*, *Sorex dobsoni*, *S. idahoensis*, *S. vagrans similis*, but it is by no means certain that they do not range up into the Hudsonian. Mammals believed to be common to the Douglas fir and Hudsonian Zones are:

Ursus americanus.
Ursus horribilis.
Gulo luscus.
Mustela pennanti.
Mustela americana
Putorius longicauda.
Arvicola macropus.
Arvicola nanus.
Erethizon epixanthus.
Tamias cinerascens.
Tamias quadrivittatus amœnus.
Sciurus richardsoni.
Sciuropterus volans sabrinus.
Lepus bairdii.
Alce americanus.
Cariacus macrotis.

Arvicola pauperrimus was found on dry knolls in this zone, but may more properly belong to the Neutral Zone. *Arvicola riparius* inhabits wet grassy places in this and the Neutral Zone.

NEUTRAL OR TRANSITION ZONE.

(Approximate altitude 1,950 to 2,300 meters or 6,400 to 7,500 feet.)

This zone is notable for what it lacks rather than for what it possesses. Its dominant and omnipresent plant is sage brush (*Artemisia tridentata*), but sage brush can not be said to be distinctive of the zone, for it occurs below throughout the Upper Sonoran, and above in the lower part of the Douglas fir Zone, where it occupies the dry barren knolls.

The Neutral Zone lacks the trees of the Canadian Zone and the greasewoods of the Sonoran Zone. Its sage plains, therefore, are purer sage than elsewhere, though invaded by a few species from above and below *Artemisia trifida* and *Bigelovia graveolens* are common in places, and *Frasera speciosa* occurs in the foothills of the Pahsimeroi Mountains. *Cercocarpus ledifolius* begins in this zone and extends up into the zone above. It is common in the foothills of the Pahsimeroi and Bruneau Mountains, but rather rare in the Salmon River Mountains. *Potentilla fruticosa* is common about springy places in this zone and in the Canadian or Douglas fir Zone also.

If any birds may be said to be characteristic of the Neutral Zone they are the Sage Hen (*Centrocercus urophasianus*) and Sharp-tailed Grouse (*Pediocætes phasianellus columbianus*). The characteristic mammals are believed to be *Arvicola pauperrimus*, *Tamias minimus pictus*, *Spermophilus elegans*, and *Neotoma cinerea*. *Arvicola pauperrimus* ranges up over the dry, sage-covered knolls of the lower part of the Canadian Zone, and *Tamias minimus pictus* follows the sage brush down into the Upper Sonoran Zone. *Spermophilus grammurus* probably belongs to the Neutral or Transition Zone, but is not widely distributed. *Arvicola riparius* is common in suitable marshes in this zone but occurs also in the zone above.

UPPER SONORAN ZONE.

(Approximate altitude below 1,950 meters or 6,400 feet.)

The only part of the great Sonoran or semi-tropical element that reaches Idaho is the upper zone of the Great Plains division of the Sonoran Province. This zone occupies the whole of the Snake Plains proper and extends up to about 1,950 meters (6,400 feet) in the valleys of east-central Idaho. Among its characteristic plants are *Atriplex confertifolia*, *A. canescens*, *A. nuttallii*, *Sarcobatus vermiculatus*, *Tetradymia canescens*, a *Malvastrum*, a cactus, and perhaps *Eurotia lanata* also. Other plants found in this zone in September and October were *Eriogonum cernuum tenue*, *Oryzopsis cuspidata*, *Iva axillaris*, and *Bigelovia douglassii*, *B. tortifolia*, *B. stenophylla*, and *B. latifolia*. Since these *Bigelovias* were found growing together near Shoshone they must be distinct species or have no rank at all.

Its characteristic mammals are a Kangaroo Rat (*Dipodops ordii*), Grasshopper Mouse (*Onychomys brevicaudus*), Pocket Mouse (*Perognathus olivaceus*), Sage Chipmunk (*Tamias minimus pictus*), Townsend's Spermophile (*Spermophilus townsendi*), and the Idaho Rabbit (*Lepus idahoensis*), though the three last-mentioned species range a little higher than the limit here assigned to the zone. The Black-tailed Jack Rabbit (*Lepus texianus*) may belong to this zone.

The characteristic birds are the Sage Sparrow (*Amphispiza belli nevadensis*), Brewer's Sparrow (*Spizella breweri*), and Sage Thrasher (*Oroscoptes montanus*). Horned Larks (*Otocoris alpestris arenicola*) are common, but occur higher up than the true Sonoran, as is the case with the Burrowing Owl and White-rumped Shrike, which species were rarely seen in the region traversed.

FOREST TREES OF THE MOUNTAINS OF SOUTH-CENTRAL IDAHO.

All the forests explored are coniferous, the only deciduous trees met with being the Aspen (*Populus tremuloides*), one or two species of Cottonwoods (chiefly *Populus balsamifera*) which grow in the bottoms along the streams, and the Western Birch (*Betula occidentalis*) which hardly attains sufficient height to be ranked as a tree. Junipers were not found except on the extreme southern spur of the mountains between Big and Little Lost River Valleys, and in the lava cañon of Snake River.*

The coniferous forests which clothe the sides of the mountains everywhere from an altitude of 2,450 meters (8,000 feet) or less to timber line (3,050 to 3,350 meters or 10,000 to 11,000 feet) are divided into two zones, an upper and a lower, which meet and overlap at an elevation of about 2,750 meters (9,000 feet). The characteristic trees of the lower zone are the Douglas Fir (*Pseudotsuga douglasii*) and Murray Pine (*Pinus murrayana*). Those of the upper zone are Alpine Fir (*Abies subalpina*), Whitebark Pine (*Pinus albicaulis*), and *Picea engelmanni*. *Picea alba* is found

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*A specimen from *Shoshone Falls* in the Snake River Cañon is identified by Mr. Holzinger as *Juniperus virginiana*.

scattered through the forest at different elevations, but does not reach timber line.

Pseudotsuga douglasii Carrière. Douglas Fir.

Douglas Fir is the prevailing tree of the lower or Canadian timber zone throughout most of the mountains and is commonly associated with *Pinus murrayana*. On the east side of the Salmon River Range it begins at an elevation of 2,300 to 2,400 meters (7,500 to 7,900 feet) and runs up to a little above 2,750 meters (9,000 feet). Along some of the mountain streams it descends lower into the valleys. Its maximum of development is attained at an altitude of about 2,450 meters (8,000 feet). Here I measured one tree which 2 meters above ground was more than 5 meters (16½ feet) in circumference and about 27 meters (90 feet) in height; another tree in the same neighborhood was 4½ meters (nearly 15 feet) in circumference, 2 meters above the ground, and 24 meters (nearly 80 feet) in height. Many others were nearly as large.

Pinus murrayana Balfour. Murray Pine; Black Pine.

Murray Pine is common throughout the Douglas fir or lower timber zone, and in some places is the prevailing tree. This is notably the case in the Saw Tooth Mountains, on the east side of which it extends from an altitude of 2,150 meters (a little over 7,000 feet) up to about 2,750 meters (9,000 feet). In the Salmon River and Pahsimeroi Mountains it forms large forests alternating or mixed with those of Douglas Fir. It rarely exceeds 300 millimeters (1 foot) in diameter. The branches of this pine are thickly beset with small cones that do not fall off when mature.

Pinus albicaulis Engelmann. White-bark Pine.

This singular pine is the dominant tree of the Hudsonian or upper timber zone in the Salmon River, Pahsimeroi, and Saw Tooth Mountains, where it grows from below 2,750 meters (9,000 feet) up to timber line. In many places it forms extensive belts in which no other trees occur; in other places it is associated with *Abies subalpina* and *Picea engelmanni*. On some of the spurs of the Salmon River Mountains *Pinus albicaulis* covers the northeastern slopes while *Abies subalpina* covers the adjacent southeastern slopes.

Though not a botanist, I am tempted to express the conviction that *Pinus albicaulis* is a perfectly good species, and not a form of *Pinus flexilis* as commonly stated in the books. Its heavy, rounded, purple cones with thick scales firmly glued together,* its peculiar bark, and even its habit of growth—the trunk splitting up near the ground into several parts of nearly equal size—serve to distinguish it at a glance from any other pine known to me.

Pinus flexilis Linnæus. White Pine.

Not common in the region traversed; grows sparingly in the Pahsimeroi Mountains.

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*A figure of one of these cones may be found in the article on Richardson's Squirrel, p. 49.

Abies subalpina Engelmann. Sub-Alpine Fir.

The Sub-Alpine fir is common in the Hudsonian or upper timber zone of the mountains of south-central Idaho, ranging from an altitude of about 2,750 meters (9,000 feet) to timber line. It is sometimes associated with *Pinus albicaulis* and *Picea engelmanni;* in other places it forms small forests alone.

Picea engelmanni (Parry). Engelmann's Spruce.

Tolerably common in the upper timber zone and usually associated with *Abies subalpina.*

Picea alba Poiret. White Spruce.

The spruce provisionally referred to this species is tolerably common throughout the lower timber zone of the mountains visited. It does not form extensive forests, but is scattered through forests of other conifers, chiefly Douglas fir. Professor Sargent, who has examined cones collected by us in the Salmon River Mountains, informs me that the tree is in some respects intermediate between *Picea alba* and *P. engelmanni.*

Populus tremuloides Michaux. Aspen.

This tree, which is commonly known in the West by the name of quakenasp, aspen, or popple, occurs along many of the streams in the bottoms, and forms groves and thickets on the sides of the mountains.

Populus balsamifera Linnæus. Balsam Poplar.

Common in some of the bottoms, particularly along Big Wood River, where it grows to be the largest deciduous tree observed by us in Idaho.

MOLLUSCS OF SOUTH-CENTRAL IDAHO.

The following species were collected by us and have been identified by Dr. R. E. C. Stearns:

Helix (Patula) hemphilli Newc.

Needle Peak, Lost River Mountains.

Limnæa lepida Gould.

Salmon River near Challis.

Limnæa palustris Müll.

Salmon River near Challis; also Saw Tooth or Alturas Lake.

Limnæa adelinæ Tryon.

Salmon River near Challis.

Planorbis trivolvis Say.

Saw Tooth or Alturas Lake.

Physa heterostropha Say.

Birch Creek.

Fluminicola nuttalliana Lea.

Salmon River near Challis; and warm springs in Snake River Cañon near Shoshone Falls.

EFFECTS OF WATER-COURSES ON THE GEOGRAPHIC DISTRIBUTION OF SPECIES.

Mountain streams, in passing down into the plains, exert a twofold influence on the distribution of animals and plants. By their constant efforts to reach base level, these streams are continually cutting down and lengthening the valleys in such a way as to produce gradually sloping bottom lands, which penetrate the highlands from the plain below, carrying with them narrow prolongations or tongues of the fauna and flora of lower levels, which follow the contour lines in a general way.

The second effect mentioned is of an exactly opposite character. The low temperature of the water, coming from melting snow-banks or cold springs in the mountains, lowers the temperature of the soil supporting the vegetation on its immediate banks, while the evaporation from its surface cools the air to which the foliage of such vegetation is exposed, thus bringing the northern or higher fauna and flora down along the immediate course of the stream.

The length of the stream and steepness of the slope determine whether the first or second effect is most pronounced. Rivers having long courses over the plains, such as the Missouri and Platte, become so thoroughly warmed during their long journey that the second effect is inappreciable, while the first is very strongly marked, southern forms of life ascending these valleys a hundred kilometers or more beyond their usual limit. Short streams, on the other hand, and particularly those that head in mountains and have rapid courses, carry northern forms many kilometers below their normal limit, but do not afford the same facility for the northward extension of southern forms. Streams of intermediate character (in the respects indicated) present intermediate conditions, and where the two types balance, the northward (or upward) and southward (or downward) extensions of the life zones are of equal length, the latter inclosing the former like the involuted finger of a glove.

ORIGIN OF THE NAME 'MARKET LAKE.'

Governor Isaac I. Stevens, in his narrative of the Pacific Railroad surveys carried on under his direction in 1853, makes the following interesting statement concerning the place known as Market Lake, which, it may be added, is now dry and occupied by ranches. Governor Stevens says:

"In years past the bed of this lake was an immense prairie bottom or basin, and a favorite resort for game of all kinds; even, indeed, the buffalo have been killed in and near it in large numbers, the evidences of which were shown by the skulls of the animals found near the present border of the lake.

"So abundant, indeed, was the game here that the trappers and mountain men of that day, who in squads and bands trapped and hunted in

is wilderness of mountains, always said to each other, when their
pply of subsistence grew scanty, 'Let us go to the market,' referring
this resort of the herds of game; and they never visited it in vain
til, by one of those strange freaks of nature in this valley of the Snake
ver, which is fed at many points throughout its length by subterra-
an streams, this market was converted into an immense sheet of
ter. It is only accounted for by supposing that the streams making
wn from the Snake River Mountains and losing themselves in the
d or sage desert of the valley, break forth at or near the latter, which
thus fed from year to year by the meltings of the snows and the rains
those mountains. In order, therefore, to retain and hand down
name of this once favorite resort, and the legend connected with it,
utenant Mullan named this sheet of water the Market Lake.
"Traveling along the banks of this lake for 8 miles, he left it, and in
hort time fell upon the main stream of Snake River, which was from
to 200 yards wide and very deep, with high clay banks on either
e, and bordered with a slight growth of willow." (Pacific R. R.
pt., vol. XII, Book 1, 1860, p. 170.)

MAMMALS OF IDAHO.

presents great diversity of physical features, comprising coniferous forests, ranges of lofty, rugged mountains, fertile, valleys, arid sage-brush plains, and alkali deserts, and it is ually divided between the Boreal and Sonoran Life Zones. Its fauna is correspondingly rich and varied. Sixty-seven species species of mammals are now known from the State and the will be increased by future explorations. The principal addi- likely to come from the bats and arvicoline mice, and except as the former group is concerned, the numerical relations of ral families are not likely to be disturbed; hence a statement umber of genera and species in each may be of interest. For ence, subspecies are here treated as species. The boreal group *æ* leads in genera but not in species, having 8 genera and 9 The family *Muridæ* comes next in number of genera and out- e *Mustelidæ* in species, having 7 genera and 13 species, and the of species is likely to be slightly increased. The *Sciuridæ* is ited by 5 genera and 10 species; the *Cervidæ* by 4 genera and ; the *Bovidæ* by 4 genera and 4 species; the *Canidæ* by 2 gen- 3 species; the *Felidæ* by 2 genera and 2 species, the *Soricidæ* *oridæ* each by 1 genus and 4 species; the *Saccomyidæ* by 2 and 2 species; the *Geomyidæ* by 1 genus and 2 species; the by 1 genus and 2 species; and the following families by 1 genus ecies each: *Hystricidæ*, *Zapodidæ*, *Lagomyidæ*, *Castoridæ*, *Procy-* The *Vespertilionidæ* is probably represented by 3 genera and 4 ecies. The genera most largely represented in species are: , 5; *Spermophilus*, 4; *Lepus*, 4; *Sorex*, 4; *Tamias*, 3. No other as more than 2 species.

CHECK LIST OF SPECIES AND SUBSPECIES.

idahoensis sp. nov.
dobsoni sp. nov.
vagrans similis subsp. nov.
palustris Richardson.
tilio nitidus H. Allen.
ys sp. —— ?
ophilus columbianus (Ord).
ophilus armatus Kennicott.
ophilus elegans Kennicott.
ophilus townsendi Bachman.

11. *Tamias cinerascens* Merriam.
12. *Tamias quadrivittatus amœnus* J. A. Allen.
13. *Tamias minimus pictus* J. A. Allen.
14. *Sciurus richardsoni* Bachman.
15. *Sciuropterus volans sabrinus* (Shaw).
16. *Castor canadensis* Kuhl.
17. *Onychomys leucogaster brevicaudus* subsp. nov.
18. *Hesperomys crinitus* sp. nov.

CHECK LIST OF SPECIES AND SUBSPECIES—continued.

19. *Hesperomys leucopus* (Rafinesque).
20. *Neotoma cinerea* (Ord).
21. *Neotoma cinerea occidentalis* Baird.
22. *Arvicola riparius* Ord.
23. *Arvicola macropus* sp. nov.
24. *Arvicola mordax* sp. nov.
25. *Arvicola nanus* sp. nov.
26. *Arvicola pauperrimus* Cooper.
27. *Phenacomys orophilus* sp. nov.
28. *Evotomys idahoensis* sp. nov.
29. *Fiber zibethicus* (Linnæus).
30. *Thomomys clusius* Coues.
31. *Thomomys clusius fuscus* subsp. nov.
32. *Dipodops ordii* Woodhouse.
33. *Perognathus olivaceus* Merriam.
34. *Erethizon epixanthus* Brandt.
35. *Zapus hudsonius* (Zimmermann).
36. *Lagomys princeps* Richardson.
37. *Lepus idahoensis* sp. nov.
38. *Lepus sylvaticus nuttalli* Bachman.
39. *Lepus texianus* Woodhouse.
40. *Lepus campestris* Bachman.
41. *Lepus bairdii* Hayden.
42. *Alce americanus* Jardine.
43. *Rangifer caribou* (Kerr).
44. *Cervus canadensis* Erxleben.
45. *Cariacus macrotis* (Say).
46. *Cariacus virginianus macrourus* Rafinesque.
47. *Antilocapra americana* Ord.
48. *Mazama montana* Rafinesque.
49. *Ovis canadensis* Shaw.
50. *Bison bison* (Linnæus).
51. *Felis concolor* Linnæus.
52. *Lynx baileyi* Merriam.
53. *Canis latrans* Say.
54. *Canis nubilus* Say.
55. *Vulpes macrourus* Baird.
56. *Taxidea americana* (Boddaert).
57. *Mephitis* sp. ——?
58. *Spilogale saxatilis* Merriam.
59. *Lutra hudsonica* (Lacépède).
60. *Mustela americana* Turton.
61. *Mustela pennanti* Erxleben.
62. *Gulo luscus* (Linnæus).
63. *Lutreola vison* (Schreber).
64. *Putorius longicauda* Bonaparte.
65. *Procyon lotor* (Linnæus).
66. *Ursus horribilis* Ord.
67. *Ursus americanus* Pallas.

ANNOTATED LIST OF THE MAMMALS OF IDAHO, WITH DESCRIPTIONS OF NEW SPECIES.

Sorex idahoensis sp. nov. Idaho Shrew.

This tiny shrew, the smallest of the three here described, is common in the Salmon River Mountains of Idaho, and was found in the Saw Tooth Mountains also. It differs widely from all known species inhabiting the western United States, as pointed out below.

SOREX IDAHOENSIS sp. nov.

[Jaws with teeth, Pl. IV, Fig. 1.]

Type No. [illegible] ♀ ad., U. S. National Museum (Department of Agriculture collection). From Timber Creek, Salmon River Mountains, Idaho, August 26, 1890. Altitude about 2,500 meters (8,200 feet). Collected by C. Hart Merriam and Vernon Bailey. (Original number, 1674.)

Measurements (taken in flesh).—Total length, 95; tail vertebræ, 40; pencil, 6; hind foot, 12.

General characters.—This shrew presents no striking external peculiarities. It is about the size of *S. platyrhinus*, which seems to be its nearest relative. It has no affinities with *S. personatus* or *vagrans.*

Color.—Upper parts dull sepia brown, darkest over the rump; under parts drab-gray, tinged with buffy. Tail bicolor, its upper and lower surfaces concolor with the corresponding surfaces of the body, with a rather long pencil, which is dusky all round.

Cranial and Dental characters.—The skull is smaller and lighter than that of *S. personatus*. The lateral unicuspidate teeth decrease in size uniformly from first to fourth; the fifth is minute but distinctly visible from the outside. This is the only species of *Sorex* yet described from anywhere west of the Rocky Mountains, so far as I am aware, in which the fourth unicuspid is smaller than the third, in which respect it resembles *S. platyrhinus* of the Eastern States.

An old nursing female, with much worn teeth (No. $\frac{24273}{31677}$), from the Saw Tooth Mountains, is here referred to this species, but, as pointed out by Dobson, it is exceedingly difficult to determine the species of shrews when the teeth are much worn.

Record of specimens collected of Sorex idahoensis.

U.S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
22519	30937	1623	Salmon River Mountains, Idaho	Aug. 23, 1890	♂?	97	42	11.5
22523	30941	1624	....do	....do	♀	97	40	11.5
22521	30939	1646	....do	Aug. 24, 1890	♀	94	38	12
22527	30945	*1674	....do	Aug. 26, 1890	♀	95	40	12
24273	31677	†1898	Saw Tooth Lake, Idaho.............	Sept. 28, 1890	♀ old..	96	37	12

* Type. †Nursing teats: $p\frac{0}{0}, a\frac{1}{1}, i\frac{2}{2} = \frac{3}{3} = 6.$

Sorex dobsoni sp. nov. Dobson's Shrew.

This interesting shrew was captured near Saw Tooth or Alturas Lake at the eastern base of the Saw Tooth Mountains in central Idaho, October 3, 1890, at which time the ground was covered with several inches of newly fallen snow. It belongs to the *Sorex personatus* group, and may be known from the following description:

SOREX DOBSONI[*] sp. nov.

[Jaws with teeth, Pl. IV, Fig. 2.]

Type No. $\frac{24274}{31678}$ ♀ ad. U. S. National Museum (Department of Agriculture collection). From Saw Tooth or Alturas Lake, Saw Tooth Mountains, Idaho, October 3, 1890. Altitude about 2,200 meters (7,200 feet). Collected by C. Hart Merriam and Vernon Bailey (original number 1929).

Measurements (taken in flesh).—Total length, 105; tail vertebræ, 47; pencil, 4.5; hind foot, 12.5.

General characters.—Similar to *S. personatus* in size and coloration, but differing in having a somewhat longer tail and in cranial and dental characters.

Color.—Upper parts uniform dull sepia brown, not darker on the rump. Under parts drab-gray slightly tinged with brown. Tail indistinctly bicolor, concolor with the upper and under surfaces of the body.

Cranial and Dental characters.—The skull is larger and heavier than that of *S. personatus*. The first and second unicuspidate teeth are largest and subequal; the third and fourth are considerably smaller and nearly subequal, but the third is a trifle smaller than the fourth; the fifth is completely in the tooth row and more than half as large as the fourth (when seen from below) and the tip is chestnut, as in all the others. Compared with *Sorex personatus*, its nearest relative, the lateral unicuspids are higher; the first, second, third, and fourth are more crowded; the first and second are larger in relation to the third and fourth; and the fifth is very much larger. All of these teeth are higher than long, while in *S. personatus* the contrary is true The first molariform tooth is conspicuously larger than in *personatus* and its principal cusp is directed more obliquely backward. The internal basal lobe of the middle incisor is rudimentary; the external lateral lobe or hook is larger than in *S. personatus*.

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[*] Named in honor of Dr. G. E. Dobson, M. A., F. R. S., etc., the distinguished author of 'A Monograph of the Insectivora.'

Record of specimen collected of Sorex dobsoni.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
24274	31678	*1929	Saw Tooth Lake, Idaho............	Oct. 3, 1890	♀	105	47	12.1

* Type.

Sorex vagrans similis subsp. nov. Shrew.

This is the commonest shrew inhabiting the marshes and borders of streams of the Salmon River Mountains, and it was found in the Pahsimeroi Mountains also. It is nearly related to *S. vagrans* of the Pacific coast region about Puget Sound, but differs from that species as pointed out below.

SOREX VAGRANS SIMILIS subsp. nov.

[Jaws with teeth, Pl. IV, Fig. 3.]

Type No. $\frac{23526}{30943}$ ♀ U. S. National Museum (Department of Agriculture collection). From Timber Creek, Salmon River Mountains, Idaho, August 26, 1890. Altitude about 2,500 meters (8,200 feet). Collected by Basil Hicks Dutcher (original number 1670).

Measurements (taken in flesh.)—Total length, 111; tail vertebræ, 46; pencil, 4; hind foot, 13.

General characters.—Similar to *S. vagrans*, but slightly larger, with the skull and mandible conspicuously larger and heavier.

Color.—Upper parts uniform dull sepia brown slightly tinged with very pale rufous. Under parts drab gray slightly tinged with buff. Tail bicolor, concolor with upper and lower surfaces of body.

Cranial and Dental characters.—Compared with *S. vagrans* the skull is large and heavy (the under jaw in particular is everywhere conspicuously thicker and heavier) and the angular process is longer. The base of the third upper unicuspidate tooth does not come down to the plane of the bases of the rest of the series. The principal cusp of the first molariform tooth is directed more obliquely backward than in *S. vagrans*; the mandibular teeth are larger, higher, and more crowded, he antero-inferior border of the second lateral tooth is emarginate tched for the reception of the posterior part of the preceding tooth.

Record of specimens collected of Sorex vagrans similis.

ational um No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skull.							
30838	1625	Salmon River Mountains, Idaho....	Aug. 23, 1890	♀	102	39	12.5
30840	1645	....do	Aug. 24, 1890	♀	110	48	13
30844	1663	....do	Aug. 25, 1890	♂	112	47	12.5
30843	*1670	....do	Aug. 26, 1890	♀	111	46	13
30912	1682	....do	....do	♀	105	45	13.5
31238	1708	....do	Aug. 28, 1890	♀	110	47	13
31312	1709	....do	....do	?	112	47	12.5
31239	1723	....do	Aug. 30, 1890	♂	117	50	12.5
31942	1796	Pahsimeroi Mountains, Idaho.......	Sept. 15, 1890	♀	100	44	13

*Type.

palustris Richardson. Marsh Shrew.

is large and handsome shrew is common along the streams and in hy places in many parts of Idaho, and is easily caught in traps d with meat.

gree with Dobson that the genus *Neosorex*, erected for this (or a ly allied) species by Baird, is not based on characters entitled to ric recognition, but differ with him in the opinion that it "can not be considered as representing a subgenus."[*] I regard *Neosorex* excellent subgenus.

Record of specimens collected of Sorex palustris.

ational um No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skull.							
30827	1537	Birch Creek, Idaho	Aug. 5, 1890	♂.....	149	72	19.5
30828	1554	....do	Aug. 8, 1890	♂.....	140	65	18
30892	1570	....do	Aug. 9, 1890	♀.....	151	73	19
30893	1580	....do	Aug. 11, 1890	♀.....	159	78	18
30834	1621	Salmon River Mountains, Idaho ...	Aug. 23, 1890	♀.....	162	75	20
30835	1622	....do	...do	♂.....	158	74	20
30832	1647	....do	Aug. 24, 1890	♂.....	164	78	20
30833	1648	....do	...do........	♀.....	156	72	20
30836	1664	....do	Aug. 25, 1890	♀ ad ..	174	82	20
31454	1858	Head of Wood River, Idaho	Sept. 26, 1890	?......	152	75	20
31766	1915	Saw Tooth Lake, Idaho.............	Sept. 30, 1890	♀.....	158	80	20
31768	1918	.... do	Oct. 1, 1890	♀.....	145	73	20
31767	1919	....do	Oct. 2, 1890	♀?....	135	57	20
30890	159	Birch Creek, Idaho	Aug. 11, 1890	♀ ...	150	74	17
30891	160	....do	Aug. 13, 1890	♂	146	72	18

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[*] *Synopsis of Genera of Soricidæ*, Proc. Zool. Soc. Lond., 1890, 51.

Vespertilio nitidus H. Allen. California Bat.

A single specimen of a small brown bat, provisionally referred to this species, was shot by Mr. Clark P. Streator on Birch Creek, August 10. It is a female, and apparently immature.

Record of specimen collected of Vespertilio nitidus.

U. S. National Museum No.	Original No.	Locality.	Date.	Sex.	Head and body.	Tail.	Head.	Ear from internal basal angle.	Tragus from inner base.	Humerus.	Forearm.	Thumb.	Third finger.	Fifth finger.	Tibia.	Hind foot.
23448	142	Birch Creek, Idaho...	Aug. 10, 1890	♀ im.	43	38	15	12	5.2	...	35	7.5	58	46	14.5	10.5

Arctomys sp. ——? Marmot.

Nearly extinct in the region traversed, though very abundant a year or two ago. Only two individuals were seen, and they were above timber line in the Salmon River Mountains. One sat at the mouth of a cave at an altitude of about 3,350 meters (11,000 feet). It seemed to have a narrow red belly and gray back. Remains of *Arctomys* are common at Big Butte and in the lava beds. The inhabitants attribute their destruction to the severe drought of the past few years.

In 1872 I collected specimens of an *Arctomys* on Henry Fork of Snake River and in the Teton Basin (Nos. 12406 and 12407, U. S. Nat. Mus.).

Spermophilus* **townsendi** Bachman. Townsend's Spermophile.

Spermophilus townsendi Bachman, Journ. Acad. Nat. Sci. Phila., vol. VIII, 1839, pp. 61–62. (Type from Plains of Columbia near the mouth of Walla Walla River. *Not* of Allen, Monog. Rodentia, 1877, pp. 848–860).

Spermophilus mollis Kennicott, Proc. Acad. Nat. Sci. Phila., 1863, p. 158. (Type from Camp Floyd, now Fairfield, Utah. This form may prove to be subspecifically separable from true *townsendi*).

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* For several years I have made a special effort to secure series of the Spermophiles of the Great Basin and Plains of the Snake and Columbia for the purpose of correcting synonymy and ascertaining the true status of the species, and have succeeded in bringing together in all about 100 specimens. The number would have been at least twice as great but for the inconvenient and seemingly unnecessary haste which these animals manifest in going into winter quarters when the summer is little more than half gone, thus disappointing the collectors, who, in several instances, reached the localities aimed at just too late.

In addition to the specimens mentioned, which are of excellent quality and accompanied by skulls, I have examined the types of all the species known to inhabit the region, namely, Bachman's *S. townsendi* (in the museum of the Philadelphia Academy of Natural Sciences), and Kennicott's *mollis*, *elegans*, and *armatus* (in the U. S. National Museum), and also, as stated in another place, have received specimens of *S. columbianus*, from within a few miles of the type locality. The conclusions resulting from this study were intended to appear first in a revision of the genus, upon which the author has been engaged for some time, but the necessity for naming species in faunal lists renders it imperative to forestall the more formal paper by an announcement of the general results so far as they relate to the determination of the species.

Common at Blackfoot and along Big Lost River and Birch Creek, and probably throughout the Snake Plains and sage-covered valleys of Idaho, as well as the Plains of the Columbia. This Spermophile is silent and shy and goes into winter quarters early; it was not seen after the middle of August. Mr. Bailey says: "Those taken were all very fat and were excellent eating, the flesh being white, tender, and sweet, without unpleasant flavor."

In 1872 I collected this species at Ross Fork, near Fort Hall, July 3, recording it under the name *Spermophilus mollis* of Kennicott (Sixth Annual Rept., U. S Geological Survey Terr., 1872, 1873, p. 664. Specimen No. $\frac{11134}{12448}$ ♂ U. S. National Museum).

It is with great reluctance that I am forced to adopt for this Spermophile a name which has been in common use for another species since 1877, but adherence to the rule of priority leaves no other course open. The type of the present species was collected by John K. Townsend, "on the Columbia River, about 300 miles above its mouth, in July," and was described by Bachman, in 1839, under the name *Spermophilus townsendi*.* Nineteen years later Professor Baird based his description "upon the original of Bachman's article, in the collection of the Philadelphia Academy of Natural Sciences," because "no specimens of this species were collected by any of the expeditions" (Mammals of N. Am., 1857, 326).

In 1863 Robert Kennicott described a Spermophile from Camp Floyd (now Fairfield), on the west side of Utah Lake, Utah, under the name *Spermophilus mollis* (Proc. Phila. Acad. Nat. Sci., 1863, 157). In 1874 J. A. Allen placed *mollis* under *townsendi* as a subspecies—an arrangement in which I fully concur, though the habitat given is erroneous (Proc. Bost. Soc. Nat. Hist., XVI, 1874, p. 293). Three years later, however, in his monograph of the group (Monog. N. Am. Rodentia, 1877, pp. 848–860), he receded from his former position, accorded full specific rank to *S. mollis*, and transferred the name *townsendi* (as a subspecies of *richardsoni*) to the animal described by Kennicott in 1863 as *S. elegans*. This course is easily explained by the fact that Allen never saw the type of *townsendi*, and was misled by the erroneous measurement of its length given by Bachman—"8 inches 9 lines," which is nearly 51^{mm} (2 inches) too much. The measurements of the hind foot and tail (correctly recorded by Bachman as "1 inch 4 lines and 1 inch" [approximately 33^{mm} and 25^{mm}] respectively), apply to this species and fall far short of the dimensions of the same parts in *S. elegans*. In *S. elegans* the hind foot averages about 41^{mm} and the tail 70^{mm}, while in *S. townsendi* the corresponding measurements are 33^{mm} and 39^{mm}. Through the courtesy of the authorities of the Philadelphia Academy of Natural Sciences, I have recently examined and measured the type of *S. townsendi*, and can not see that it differs in any way from the series collected by our party on the Snake Plains of Idaho. The length of the hind foot is a fraction less than 33^{mm}.

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* Jour. Phila. Acad. Nat. Sci., vol. VIII, 1839, pp. 61, 62.

Record of specimens collected of Spermophilus townsendi.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23025	30471	1419	Blackfoot, Idaho	July 10, 1890	♂	195	45	32
23063	30509	1436	....do	July 12, 1890	♂	209	49	32.5
23061	30507	1438	....do	July 14, 1890	♂	188	39	30
23064	30510	1440	....do	July 15, 1890	♂	210	46	32
23066	30512	1449	....do	July 16, 1890	♂	202	44	34
23926	31331	1463	Big Lost River, Idaho	July 22, 1890	♀	198	37	32
23927	31332	1486	....do	July 24, 1890	♂	198	40	31
23332	30791	1534	Birch Creek, Idaho	Aug. 4, 1890	♂	176	39	29
23489	30907	1573	....do	Aug. 9, 1890	♂	188	43	31
23490	30908	1576	....do	Aug. 10, 1890	♂	183	40	30
23024	30470	3	Blackfoot, Idaho	July 10, 1890	♂	207	45	32
23067	30513	33	....do	July 16, 1890	♂	195	43	30
23933	31338	43	Big Lost River, Idaho	July 22, 1890	♂	191	50	32
23065	30511	44	....do	....do	♂	192	53	31
23932	31337	46	....do	....do	♂	208	43	33
23930	31335	*47	....do	....do	♂	210	44	32
23931	31336	48	....do	....do	♂	204	39	33
23929	31334	51	....do	July 23, 1890	♂	181	89	31
23925	31330	53	....do	....do	♂	206	43	32
23928	31333	54	....do	....do	♀	175	40	31
23334	30793	90	Birch Creek, Idaho	Aug. 4, 1890	♀	167	35	30
23331	30790	117	....do	Aug. 6, 1890	♂	177	34	29
23333	30792	130	....do	Aug. 8, 1890	♂	180	32	30
23492	30910	162	....do	Aug. 13, 1890	♂	187	33	29

Spermophilus armatus Kennicott. Mountain Spermophile.

Spermophilus armatus Kennicott, Proc. Acad. Nat. Sci. Phila., 1863, p. 158 (type from foothills of Uinta Mountains near Fort Bridger, Wyoming).

This species inhabits the Blackfoot Mountains east of the town of Blackfoot, on Snake River, where Mr. Bailey found it common from the foothills to the higher parts of the range. The ranchmen living along the foothills complain that their crops suffer from its depredations. It may occur also in other mountain ranges visited, but had denned up before these mountains were reached. Burrows of some species of Spermophile abound in the Sawtooth and Pahsimeroi Mountains. The local name Picket Pin, by which Spermophiles are known in Idaho and other parts of the west, is suggestive of the upright position these animals assume when sitting at the mouths of their holes.

Record of specimen collected of Spermophilus armatus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23062	30508	1435	Blackfoot Mountains, Idaho	July 12, 1890	♀	275	68	45

mophilus elegans Kennicott. Kennicott's Spermophile.

ıophilus elegans Kennicott, Proc. Acad. Nat. Sci. Phila., 1863, p. 158 (type from Fort Bridger, Wyoming).

ıophilus richardsoni var. *townsendi* Allen, Monog. Rodentia, 1877, p. 848+ (*not S. townsendi* of Bachman, 1839).

ommon in the sage brush of the Neutral zone on the sides of Birch k and Lemhi Valley (just below the Canadian or Douglas fir zone above the Sonoran); probably common in many similar localities ed, but hibernating so early that it was not observed. The last imen seen was captured August 22.

1872 I collected this species at Henry Lake and near Teton Cañon ıly and August (Nos. $\frac{11104}{12418}$, $\frac{11105}{12419}$, $\frac{11115}{12431}$, $\frac{11116}{12432}$, U. S. Nat. Mus.). ıis species has been long known as *S. townsendi*, but the name *sendi* was originally applied (by Bachman) to the small gray Spermophile of the Plains of the Columbia and Snake Rivers, to which ies it is here restored. The present species, therefore, requires her name, which is found in the *S. elegans* of Kennicott. As Kentt stated, it "is most nearly related to *S. richardsoni*," from which ıy be found to differ subspecifically only.

Record of specimens collected of Spermophilus elegans.

National ·um No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
	Skull.							
)	30789	1548	Birch Creek, Idaho	Aug. 7, 1890	♂	271	70	42
)	30978	1501	....do	Aug. 12, 1890	♂	252	62	41
l	30909	116	....do	Aug. 6, 1890	♂	256	68	42
8	31198	1607	Lemhi Valley, Idaho	Aug. 19, 1890	♀	255	73	40

mophilus columbianus (Ord). Burrowing Squirrel.

mys columbianus Ord, "Guthrie's Geog., 2d Am. ed., II, 1815, pp. 292–303" (based on the 'Burrowing Squirrel' of Lewis and Clark).

ıyx brachiura Rafinesque, Am. Monthly Mag., II, 1817, p. 45 (based on the 'Burrowing Squirrel' of Lewis and Clark).

mys brachyura Harlan, Fauna Americana, 1825, pp. 304–306.

mys (Spermophilus) parryi, var. B. *erythrogluteia* Richardson, Fauna Boreali-Americana, I, 1829, p. 161.

ıophilus parryi var. *erythrogluteia* Allen, Proc. Bost. Soc. Nat. Hist., XVI, 1874, p. 292.

ıophilus empetra var. *erythroglutæus* Allen, Monog. Rodentia, 1877, p. 839.

rowing Squirrel" Lewis and Clark, Paul Allen ed., 1814, II, pp. 173, 174 (description), 312 (locality).

ıis Spermophile is abundant in northwestern Idaho and may inhabit ıorthern part of the region traversed by our party, but it goes into er quarters so early that it was not captured. It is common in the rwater region, living in colonies in the prairies. I have speci- from Moscow and Grangeville. Mr. Clay McNamee writes me from Moscow, Idaho: "These Spermophiles live in colonies like prairie dogs, and are very abundant in this district. Many can be killed within the city limits of Moscow in the spring. In making their burrows some dirt is thrown out, making a small mound, generally of a circular form. The mounds range from 3 to 10 inches in height. The hole or burrow generally goes straight down for 18 inches or 2 feet. The animals when disturbed sit up erect like a prairie dog and watch a person until within a few yards and then rush into their holes, uttering a series of short squeaks or whistles. When one is shot, unless killed quite dead, it is almost sure to get away. They hibernate during the winter and fall. Nearly all disappear about the 15th of July and remain until the next spring. On account of this habit they are called 'Seven sleepers' as they stay underground about 7 months. They are very fat when they go into winter quarters and are so poor when they come out in the spring that they can hardly walk."

This animal is the 'Burrowing Squirrel' of Lewis and Clark, and the synonymy at the head of this article will be a great surprise to most mammalogists, for the 'Burrowing Squirrel' has been long believed to be a prairie dog (*Cynomys*), while it now proves to be the ground squirrel described by Richardson in 1829 under the name *Arctomys* (*Spermophilus*) *parryi* var. *erythrogluteia*, which is the same animal as the *Spermophilus empetra* var. *erythroglutæus* of Allen, 1877.

Baird, in 1857, cited Ord's *Arctomys columbianus* as a questionable synonym of his own *Cynomys gunnisoni*,* with the following explanation: "Lewis and Clark mention a Burrowing Squirrel from the plains of the Columbia which appears to be a *Cynomys*, and may possibly be the same with the species here described,"—namely, *C. gunnisoni*.

Allen, in 1874, adopted the name *Cynomys columbianus* for the Plateau Prairie Dog, under which *C. gunnisoni* of Baird was given as a synonym; and in 1877 he stated: "the name *columbianus* of Ord becomes the only tenable specific designation" for the prairie dog in question.†

Several years ago I began to doubt that any species of Prairie Dog occurred on the plains of the Columbia, and subsequent investigation satisfied me that my suspicion was well founded. Therefore, in writing of the Plateau Prairie Dog in a recent publication,‡ I discarded the name *Cynomys columbianus* and substituted therefor *Cynomys gunnisoni* of Baird, but did not state the reasons for so doing. Having ascertained positively that no Prairie Dog inhabits any part of the Plains of the Columbia or the region bordering thereon, I set out to procure series of the Spermophiles of the area in the hope of determining the identity of the 'Burrowing Squirrel' of Lewis and Clark, to which the scientific name *Arctomys columbianus* was given by Ord in 1815.[*]

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* Mammals of North America, 1857, p. 335.

† Monographs of Rodentia, 1877, p. 906.

‡ Report on the Results of a Biological Survey of San Francisco Mountain, Arizona, N. Am. Fauna, No. 3, September, 1890, pp. 58, 59.

The narrative of Lewis and Clark's Expedition[†] contains the statement: "We saw many sandhill cranes, and some ducks in the marshes near our camp, and a greater number of burrowing squirrels, some of which we killed and found them as tender and well flavored as our gray squirrels." The context shows that the precise locality to which they refer is a camas (called by them 'Quamash') prairie between the forks of the Clearwater or Kooskooskie. I have succeeded in obtaining a fine series of specimens of the large Ground Squirrel which abounds in this region. Most of these specimens were procured in the neighborhood of Moscow, not more than 65 kilometers (about 40 miles) distant (in a northwesterly direction) from the very spot where Lewis and Clark killed their specimens. Others were obtained near Grangeville, a still shorter distance (48 kilometers or about 30 miles south) from the type locality. These animals belong to the species generally known as a form of Parry's Spermophile (*Spermophilus empetra erythrogluteus*). The detailed description of the 'burrowing squirrel' given by Lewis and Clark applies in every particular[‡] to this animal, while it does not apply at all to any Prairie Dog or in fact to any other known species of North American mammal. It seems absolutely certain, therefore, that the 'burrowing squirrel' of Lewis and Clark is the present animal, and consequently that the specific name *columbianus* applied to it by Ord in 1815 becomes the only available name for the species.

Stated briefly, the two reasons which render this change imperative are, first, that Lewis and Clark's description fits this particular species, and second, that no other animal which can by any possibility be made to agree with their description inhabits the region.

In the words of Dr. Allen: "As the whole synonymy of the species turns upon Lewis and Clark's description, I quote it in full."[§] Lewis and Clark's description is as follows:

"There is also a species of squirrel, evidently distinct, which we have denominated the burrowing squirrel. He inhabits these plains, and somewhat resembles those found on the Missouri; he measures 1 foot and 5 inches in length, of which the tail comprises 2½ inches only; the neck and legs are short; the ears are likewise short, obtusely pointed, and lie close to the head, and the aperture larger than will generally be found among burrowing animals. The eyes are of a moderate size, the pupil black, and the iris of a dark sooty brown; the whiskers are full, long, and black; the teeth, and, indeed, the whole contour, resemble those of the squirrel; each foot has five toes; the two inner ones of the fore feet are remarkably short, and are equipped with blunt nails; the remaining toes on the front feet are long, black, slightly curved, and sharply pointed; the hair of the tail is thickly inserted on the sides only, which gives it a flat appearance, and a long oval form; the tips of the hair forming the outer edges of the tail are white, the other extremity of a fox red; the under part of the tail resembles an iron gray; the upper is of a reddish brown; the lower part of the jaws, the under part of the neck, legs, and feet, from the body and belly downwards, are of a light brick red; the nose and eyes are of a darker shade of the same color; the upper part of the head, neck, and body, are of a curious brown gray, with a slight tinge of brick red; the longer hairs of these parts are of a reddish white color at their extremities, and falling together, give this animal a speckled appearance. These animals form in large companies, like those on the Missouri, occupying with their burrows sometimes 200 acres of land; the burrows are separate, and each possesses, perhaps, ten or twelve of these inhabitants. There is a little mound in front of the hole formed of the earth thrown out of the burrow, and frequently there are three or four distinct holes, forming one burrow, with these entrances around the base of these little mounds. These mounds, sometimes about 2 feet in height and 4 in diameter, are occupied as watch towers by the inhabitants of these little communities. The squirrels, one or more, are irregularly distributed on the tract they thus occupy, at the distance of 10, 20, or sometimes from 30 to 40 yards. When any one approaches they make a shrill whistling sound, somewhat resembling tweet, tweet, tweet, the signal for their party to take the alarm, and to retire into their intrenchments. They feed on the roots of grass, etc."*

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[*] In the second American edition of Guthrie's Geography, a very rare book.

[†] Paul Allen edition, vol. II, 1814, p. 312.

[‡] The only possible exception is the length of the tail, which is said to be only 2½ inches (about 63$^{\mathrm{mm}}$). As a matter of fact it averages a little over 100$^{\mathrm{mm}}$ (4 inches). The tail may have been unusually short, or the tip may have been broken off in the specimen they measured.

[§] Monographs of N. Am. Rodentia, 1877, p. 904.

Tamias cinerascens Merriam. Gray Ground Squirrel.
Tamias cinerascens Merriam, N. Am. Fauna, No. 4, Oct., 1890, p. 20 (type from Helena, Montana).

Abundant in the Salmon River, Saw Tooth, and Pahsimeroi Mountains, living in colonies in rocky places, often above timber line, and hibernating early; not found below the Douglas fir zone. By the middle of August this species had become excessively fat and appeared during the hottest days only; after the first of September it was rarely seen. The majority of the specimens obtained still had the red mantle, though a number were in various stages of the change from red to gray.

Two were killed as late as September 23 (a warm day) on the divide beween the headwaters of Big Lost River and those of Trail Creek, though none had been seen for about three weeks. On a warm afternoon two days later (September 25) two more were killed and others n the upper part of Wood River Valley and on the divide be- the head of Wood River and that of Salmon River.

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* *Lewis and Clark's Travels*, Paul Allen edition, vol. II, 1814, pp. 173, 174.

caño on the west side of the Lost River Mountains (southern uation of the Salmon River Range) Mr. Bailey met with a colony embers of which differ in habits from those previously known, in- h as they climb trees. Mr. Bailey says: "They climb trees read- Ve shot several from 6 to 30 feet high in trees, and frequently saw n bushes after berries. They are very fond of ripe gooseberries, t the seeds of numerous small plants."

872 I collected this species at Henry Lake, August 10 (No. $\frac{11103}{12417}$, Nat. Mus.).

Record of specimens collected of Tamias cinerascens.

tional u No. Skull.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
30748	1497	Lost River Mountains, Idaho	July 29, 1890	♀ ad.	293	110	44
30749	1498	....do	....do	♀	271	100	44
30752	1499	....do	....do	♂	278	100	43
30722	1505	....do	July 30, 1890	♀ ad.	278	80	44.5
30750	1506	....do	....do	♀ ad.	286	109	42
30751	1507	....do	....do	♀ ad.	273	91	44
30714	1508	....do	....do	♀	284	112	43
30721	1509	....do	....do	♀	284	107	45
30716	1510	....do	....do	♀	258	94	42
30754	1511	....do	....do	♀	278	107	46
30753	1512	....do	....do	♂	213	82	40
30723	1520	....do	July 31, 1890	♀ ad.	303	112	44
30715	1521	....do	....do	♂ im.	277	110	44
30868	1542	....do	Aug. 6, 1890	♀ ad.	273	87	40
30737	61	....do	July 28, 1890	♂	256	101	47
30720	62	....do	July 29, 1890	♀	281	101	44
30707	63	....do	....do	♀	274	100	44
30717	64	....do	....do	♂	270	106	45
30713	65	....do	....do	♀	265	105	44
30708	66	....do	July 30, 1890	♂	257	104	44
30719	67	....do	July 29, 1890	♂	240	99	45
30706	69	....do	July 30, 1890	♂	295	111	45
30712	70	....do	....do	♀	290	102	44.5
31388	71	....do	....do	♀	270	115	45
30718	72	....do	....do	♂	234	95	42
30710	73	....do	....do	♂	237	87	41
30709	81	....do	July 31, 1890	♀	262	95	44
30725	82	....do	....do	♂	261	101	44
30724	83	....do	....do	♀	279	109	45
30979	1583	Birch Creek, Idaho	Aug. 11, 1890	♂	276	94	43
30980	1584	....do	....do	♂	295	114	45
30867	115	....do	Aug. 6, 1890	♂	297	105	45
30981	143	....do	Aug. 11, 1890	♀	256	71	41
30869	144	....do	....do	♂	267	64	44
31052	1608	Salmon River Mountains, Idaho	Aug. 19, 1890	♀	275	97	41
30987	1609	....do	....do	♂	258	89	42

Record of specimens collected of Tamias cinerascens—Continued.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23659	31053	1637	Salmon River Mountains, Idaho	Aug. 23, 1890	♂	265	93	44
23660	31054	1655	...do	Aug. 25, 1890	♂	275	93	47
23661	31055	1671	...do	Aug. 26, 1890	♀	290	102	46
23779	31179	1699	...do	Aug. 27, 1890	♂	292	106	44
23564	30982	173	...do	Aug. 19, 1890	♂	263	81	45
24276	31680	1850	Summit, Alturas Co., Idaho	Sept. 23, 1890	♀	282	98	45
24277	31681	1851	...do	...do	♂	255	75	42
24275	31679	1852	Head of Wood River, Idaho	Sept. 25, 1890	♂	290	97	46
24278	31682	1853	...do	...do	♂	258	92	43

Tamias quadrivittatus amœnus Allen.* Klamath Chipmunk.

Abundant throughout the Canadian and Hudsonian forests of central Idaho, descending as low as the upper part of the sage-covered foothills, and occuring, though not abundantly, as high as timber line on the mountains. Just above timber line in the Salmon River Mountains this chipmunk was observed collecting large mouthfuls of the white wool from the beds of dwarf willows (*Salix reticulata*), which are only about 2 inches in height. In the Saw Tooth Mountains during the early part of October it was very abundant and remained active during cold weather, even after the ground was covered with snow, running about and tunneling in the soft snow after the manner of Red Squirrels—a habit I have never before observed in a Chipmunk. It is an active, sprightly animal and climbs trees freely, though rarely going high. Its principal food in the region about Saw Tooth Lake at the time of our visit (last of September and early October) consisted of the seeds of *Pinus murrayana*, of which I removed not less than 332 from the cheek pouches of a single individual.

Seventy-four specimens of this Chipmunk were collected and brought back to Washington—a sufficient series to illustrate many points of seasonal, geographic, and individual variation. All the specimens from the Saw Tooth Mountains are nearly typical *amœnus*, and those from the Pahsimeroi and Lost River Mountains are fairly referable to the same form. Those from the northern Salmon River Mountains show a strong tendency to run into *luteiventris*,† just half of the specimens collected having a decided fulvous wash across the belly. Dr. J. A. Allen, to whom I submitted the specimens, writes:

"If No. 23568 [a yellow-bellied specimen] fairly represents the Salmon River series, I should not hesitate to label them *Tamias quadrivittatus*

***Tamias amœnus* Allen, Bull. Am. Mus. Nat. Hist., III, No. 1, June, 1890, pp. 90-92 (type from Fort Klamath, Oregon).

†*Tamias quadrivittatus luteiventris* Allen, Bull. Am. Mus. Nat. Hist., III, No. 1, 1890, pp. 102-103 (type from Chief Mountain Lake, Montana).

luteiventris. On the other hand, I do not see how it is possible to do otherwise than to refer the Saw Tooth Lake, the Pahsimeroi Mountains, the Lost River Mountains, and the Birch Creek series to *Tamias amœnus.*"

Record of specimens collected of Tamias quadrivittatus amœnus.

U.S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
[illegible]	31422	1860	Saw Tooth Lake, Idaho	Sept. 26, 1890	♂	195	80	32
[illegible]	31421	1861	....do	....do	♀	203	80	32
[illegible]	31420	1865	....do	....do	♂	213	88	33
[illegible]	31423	1866	....do	....do	♀	212	92	33
[illegible]	31426	1867	....do	....do	♂	195	84	32
[illegible]	31427	1868	....do	....do	♂	202	88	33
[illegible]	31417	1869	....do	....do	♂	195	78	32
[illegible]	31419	1870	....do	....do	♂	195	78	33
[illegible]	31415	1871	....do	....do	♂	185	73	32
[illegible]	31418	1872	....do	....do	♀	194	80	33
[illegible]	31425	1889	....do	Sept. 28, 1890	♂	210	87	32
[illegible]	31684	1909	....do	Sept. 29, 1890	♀	210	90	32.5
[illegible]	31842	1917	....do	Sept. 30, 1890	♂	202	80	33
[illegible]	30485	1456	Big Butte, Idaho	July 19, 1890	♀ ad.	209	93	32.5
22237	30694	1490	Arco, Idaho	July 25, 1890	♂	213	98	34
22223	30680	1491	....do	July 26, 1890	♀	216	106	34
[illegible]	30693	59	....do	July 29, 1890	♂	207	100	33
22220	30677	74	Lost River Mountains, Idaho	July 30, 1890	♂	195	93	33
22228	30685	75	....do	....do	♀	192	86	33
22222	30679	76	....do	....do	♂	197	92	33
22226	30683	77	....do	....do	♀	200	91	33
22229	30686	78	....do	....do	♂	201	94	33
22221	30678	79	....do	....do	♀	202	95	32
22225	30682	80	....do	July 31, 1890	♂	201	86	32
22230	30687	1500	....do	July 29, 1890	♀ ad.	213	95	32
22224	30681	1300	....do	....do	♀	204	93	32
22233	30690	1502	....do	....do	♂	208	98	32
22232	30689	1503	....do	....do	♂	205	96	32
22219	30676	1513	....do	July 30, 1890	♀	207	92	33
22227	30684	1514	....do	....do	♀	210	97	33
22235	30692	1515	....do	....do	♀ im.	195	92	32
22231	30688	1516	....do	....do	♂	212	98	33
22234	30691	1517	....do	....do	♂	206	96	32
22297	30756	1543	....do	Aug. 6, 1890	♂	211	96	33
22302	30761	1544	....do	....do	♀	210	93	32
22328	30787	1545	....do	....do	♂	213	95	34
22296	30755	1546	....do	....do	♂	190	77	33
23450	30677	1586	....do	Aug. 11, 1890	♂	210	88	32
22329	30788	110	....do	Aug. 6, 1890	♂	212	68	32
22326	30785	111	....do	....do	♀	187	93	33
22325	30784	112	....do	....do	♀	209	63	31.5
22327	30786	113	....do	....do	♀	210	93	33
23452	30670	149	....do	Aug. 11, 1890	♀	211	88	31
23465	30683	150	....do	....do	♂	207	60	33
23453	30671	151	....do	....do	♀	211	91	[illegible]

Record of specimens of Tamias quadrivittatus amœnus—Continued.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.
Skin.	Skull.						
23463	30881	152	Lost River Mountains, Idaho	Aug. 11, 1890	♀	210	93
23457	30875	153	....do	....do	♀	211	94
23454	30872	154	....do	....do	♂	206	88
23460	30878	155	....do	....do	♀	207	89
23571	30989	1610	Salmon River Mountains, Idaho	Aug. 19, 1890	♂	207	95
23570	30988	1611	....do	....do	♀	205	95
23652	31046	1639	....do	Aug. 23, 1890	♂	214	95
23654	31048	1640	....do	....do	♂	215	95
23653	31047	1641	....do	....do	♂	220	100
23657	31051	1642	....do	....do	♀	221	97
23651	31045	1643	....do	....do	♀	210	91
23656	31050	1651	....do	Aug. 24, 1890	♀	220	102
23655	31049	1652	....do	....do	♂	218	95
23662	31056	1653	....do	Aug. 25, 1890	♂	205	88
23650	31044	1654	....do	....do	♀	204	87
23781	31181	1703	....do	Aug. 27, 1890	♀	215	90
23782	31182	1704	....do	....do	♀	205	90
23783	31183	1705	....do	....do	♀	205	80
23780	31180	1706	....do	....do	♀	192	83
23777	31177	1722	....do	Aug. 30, 1890	♂	202	79
23567	30985	172	....do	Aug. 19, 1890	♀	126	82
23566	30984	182	....do	Aug. 22, 1890	♀	208	86
23565	30983	183	....do	....do	♀	206	87
23568	30986	184	....do	....do	♀	195	86
23788	31188	1771	Lemhi Valley, Idado	Sept. 4, 1890	♀	212	90
23895	31299	1787	Pahsimeroi Mountains, Idaho	Sept. 14, 1890	♀	214	90
23898	31302	1788	....do	....do	♂	215	93
23896	31300	1801	....do	Sept. 15, 1890	♂	220	94
23993	31416	1845	Head of Big Lost River, Idaho	Sept. 22, 1890	♂	215	96

Tamias minimus pictus Allen. Great Basin Chipmunk.

Tamias minimus pictus J. A. Allen, Bull. Am. Mus. Nat. Hist., III, No. 1, June 115–116 (type from Kelton, Utah).

Tamias minimus melanurus Merriam, N. Am. Fauna, No. 4, Oct., 1890, 22 (typ Blackfoot, Idaho).*

Common locally but not evenly distributed throughout the S Plains of Idaho and the larger sage-covered valleys of the moun Colonies were observed in the valley of Birch Creek and Lemhi and in Big Lost, Little Lost, Pahsimeroi, and Round Valleys, a the valley at the headwaters of Salmon River (at the east foot o Saw Tooth Mountains).

These Chipmunks were often seen climbing about in the sage and greasewood, feeding on the seeds of *Artemisia tridentata* and

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*Additional specimens indicate that this supposed subspecies really repre peculiar phase of the molt, in which the submarginal black band has not out far enough to show the fulvous bases of the hairs.

s vermiculatus. Specimens killed often had their cheek pouches ded with the seeds of these plants. In the Pahsimeroi Valley ame to our camp for crumbs and were such a nuisance we were to kill them. The species was seen as late as October 4 in the at the head of Salmon River, at the east foot of the Saw Tooth tains.

Record of specimens collected of Tamias minimus pictus.

tional n No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skull.							
30580	1420	Blackfoot, Idaho	July 11, 1890	♂	165	67	29
30575	1437	....do	July 12, 1890	♂	195	92	32
30491	1439	...do	July 14, 1890	♂	188	90	29
30486	1445	....do	July 15, 1890	♀ ad.	190	83	29
30490	1446	....do	July 16, 1890	♀	198	95	30
30488	1447	....do	....do	♂	189	90	29
30494	1451	....do	July 17, 1890	♂ im.	....	84	29
30493	1459	Big Lost River, Idaho	July 21, 1890	♂	185	88	29.5
30495	1460	....do	....do	♂	188	91	29.5
30489	1461	...do	....do	♀	185	91	30
30492	1462	...do	....do	♀	195	96	30
30484	1464	...do	July 22, 1890	♀	195	93	30
30487	1465	...do	... do	♀	183	88	29
30498	1480	....do	July 23, 1890	♂	184	87	28
30499	1481	....do	....do	♂	190	92	29
30496	1482	....do	....do	♂	192	94	29
30497	1483	....do	....do	♂	189	91	29
31321	1487	....do	July 24, 1890	♂	182	90	28
30764	1528	Birch Creek, Idaho	Aug. 4, 1890	♂	186	85	29
30768	1529	....do	....do	♂	186	90	30
30759	1530	....do	....do	♀	195	88	29.5
30763	1549	....do	Aug. 7, 1890	♂	192	87.5	30
30758	1556	....do	Aug. 6, 1890	♂	183	85	29
30762	1559	....do	Aug. 7, 1890	♂	188	85	29
30879	1587	....do	Aug. 11, 1890	♂	191	87	28
30765	1590	....do	....do	♂	189	85	28
31176	1734	Junction, Idaho	Aug. 31, 1890	♀ im.	202	93	29
31178	1735	....do	... do	♀ im.	190	90	28
31172	1744	Lemhi, Idaho	Sept. 2, 1890	♂	188	88	29
31173	1745	....do	....do	♀	204	96	31
31175	1746	....do	....do	♂	185	86	29
31169	1747	....do	....do	♀	188	87	31
31171	1760	....do	Sept. 3, 1890	♀	195	89	27
31189	1770	Lemhi Valley, Idaho	Sept. 4, 1890	♂	188	84	30
31187	1776	Little Lost River, Idaho	Sept. 11, 1890	♂	188	85	29
31186	1777	....do	....do	♂	190	83	29
31185	1778	...do	....do	♀	198	85	30
31184	1779	....do	....do	♀	182	82	29
......	1786	Pahsimeroi Mountains, Idaho	Sept. 14, 1890	♀	186	86	30
31297	1817	Pahsimeroi Valley, Idaho	Sept. 16, 1890	♀	198	85	30
31296	1818	...do	...do	♂	190	80	29.5
31298	1819	....do	....do	♀	195	86	30
31304	1820	....do	....do	♂	200	87	31

Record of specimens collected of Tamias minimus pictus—Continued.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
....	31168	1824	Pahsimeroi Valley, Idaho	Sept. 17, 1890	♀	192	82	30
23897	31301	1825	....do	... do	♀	195	83	30
23899	31303	1826	....do	....do	♀ im.	184	79	30
24001	31424	1859	Upper Salmon Valley, Idaho	Sept. 25, 1890	♀	192	76	30
23307	30766	1560	Birch Creek, Idaho	Aug. 7, 1890	♀	178	74	29
23308	30767	1564	....do	... do	♀	188	88	28
23298	30757	1588	....do	Aug. 11, 1890	♂	187	86	28
23311	30770	1589	....do	....do	♀	200	94	30
23770	31170	1743	Lemhi, Idaho	Sept. 2, 1890	♀	192	86	30.5
23774	31174	1761	....do	Sept. 3, 1890	♀	190	90	28
23131	30576	4	Blackfoot, Idaho	July 11, 1890	♀	197	90	29
23134	30579	5	....do	....do	♂	195	91	31
23129	30574	6	....do	....do	♀	173	66	29
23136	30581	14	....do	July 13, 1890	♂	193	90	30
23128	30573	15	....do	....do	♀	193	89	29
23132	30577	16	....do	....do	♂	179	89	28.5
23059	30505	40	Big Lost River, Idaho	July 21, 1890	♀	197	91	30
23055	30501	41	....do	July 22, 1890	♀	185	87	29
23058	30504	42	....do	....do	♂	178	81	29
23057	30503	49	....do	... do	♂	184	90	29
23056	30502	50	....do	....do	♂	181	88	29.5
23915	31320	55	....do	July 24, 1890	♀	155	49	18
23054	30500	39	....do	July 21, 1890	♀	197	94	30
23238	30695	58	Arco, Idaho	July 25, 1890	♀	196	97	29
23239	30696	60	Little Lost River, Idaho	July 27, 1890	♀	185	87	30
23324	30783	114	Birch Creek, Idaho	Aug. 6, 1890	♂	181	82	29
23310	30769	131	....do	Aug. 8, 1890	♂	186	87	28
23301	30760	136	....do	Aug. 9, 1890	♀	182	79	29
23464	30882	156	....do	Aug. 11, 1890	♀	189	80	27
23466	30884	157	....do	....do	♀	196	92	27.5
23456	30874	158	....do	....do	♂	177	86	27
23458	30876	161	....do	Aug. 13, 1890	♂	193	90	29
23462	30880	165	....do	Aug. 14, 1890	♂	184	89	27
23455	30873	166	....do	....do	♂	154	52	27

Sciurus richardsoni Bachman. Richardson's Squirrel.

Sciurus richardsoni Bachman, Proc. Zoöl. Soc. Lond., vol. VI, 1838, pp. 100, 101 (type from mountains at head of Big Lost River, Idaho).

Richardson's Squirrel is the most conspicuous mammal of the coniferous forests of central Idaho, and is common from the lower edge of the zone of Douglas fir and Murray pine to timber line, where the prevailing trees are the white-bark pine and alpine fir. It feeds upon the seeds of these conifers and also upon those of *Picea alba*, and the mouths of its burrows are often nearly hidden by the piles of scales which accumulate about its home. The large seeds of the white-bark pine (*Pinus albicaulis*) are especially sought for, and the peculiar character of the cone of this species has given rise to a clever method of gaining cess to the seeds. The scales of the cones are very thick and are rmly glued together, instead of being separate as usual among conifers. o reach the seeds the squirrel gnaws a hole in one side of the cone by eans of which he extracts all of the seeds, just as our eastern squirrels btain the meats of the larger nuts. A cone thus gnawed is shown in he accompanying figure. Squirrels ordinarily reach the seeds of conifers by stripping off the scales from the cones.

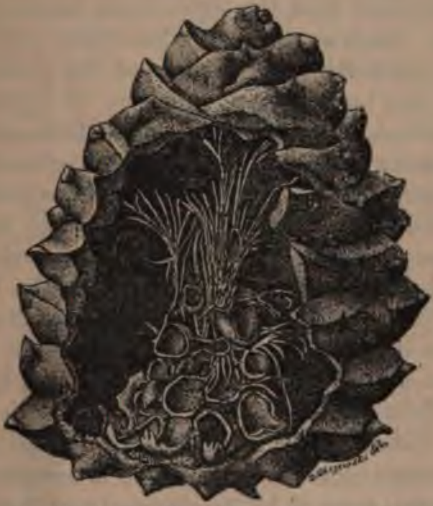

FIG. 1.—Cone of White-bark Pine gnawed by Richardson's Squirrel.

Richardson's Squirrel lives in burrows under decayed logs or among e roots of trees, and in nests in the branches. These nests are made dry grass and other materials, and are usually placed against the unk of the tree. They are probably used in summer only, and resemble e summer nests of the common Eastern Red Squirrel (*Sciurus hud- nicus*).

The ordinary note and scolding chipper of this squirrel are nearly entical with those of its eastern congener; and in general the habits the two are similar. Our marten traps baited with squirrels, chip- unks, mice, and birds, captured Richardson's Squirrel more frequently an any other mammal.

Richardson's Squirrel was discovered by John K. Townsend during s overland journey to Oregon in 1834, and was described by Dr. Bach- an in 1838, under the name *Sciurus richardsoni*. The type locality ven is "the high range of the Rocky Mountains west of the great ain" (P. Z. S., 1838, 100), which was interpreted by Allen as meang the Bitter Root Range (Monog. Rodentia, 1877, 686). Bachman tes that the label on Townsend's specimen bore the date "August 1834" (Journal Acad. Nat. Sci. Phila., VIII, 1839, p. 67). A critical examination of Townsend's Narrative shows that on the date mentioned he was attempting to cross the high mountains between the headwaters of Big Lost River (then known as 'Goddin's Creek') and Big Wood River (then known as the Malade—a name still applied to the lower part of the same stream where it crosses the Snake Plains)*. During the past season (in September, 1890) I followed part of Townsend's route and obtained specimens of the squirrel in question at a point not more than a few miles from the spot where his type was secured 56 years previously. Such a specimen is No. $\frac{24055}{31471}$ ♀, U. S. Nat. Museum, collected in the mountains at the head of Big Lost River, September 22, 1890, which may be regarded, therefore, as typical of the species. It was described as a very small squirrel—in fact, as the "most diminutive of all the known species of genuine squirrel in North America"—but Professor Baird who examined the type specimen pointed out the important fact that it is *immature* (Mammals of N. Am., 1857, 274, footnote). This type specimen, collected by Townsend more than half a century ago, is before me as I write (thanks to Mr. Witmer Stone and the authorities of the Philadelphia Academy of Natural Sciences, to which institution it belongs), and is matched almost exactly by several young specimens, about two-thirds grown, collected by me near the type locality. The black terminal part of the tail, which is the chief characteristic of the species, is not so pronounced in the young as in adults, and the tip is broken off in the type (which is mounted) and the remaining part is somewhat masked by the circumstance that the tail is twisted on its own axis, thus mixing the red and black hairs in such a way as to conceal the predominance of the latter. Townsend stated that "about an inch and three-fourths" of the terminal part of the tail was black, and Bachman remarked that the species could always be distinguished "by the blackness of its tail at the extremity." The whiteness of the incisors spoken of by Bachman is due to immaturity. (P. Z. S., 1838, 100.)

Professor Baird characterized the species correctly when he stated that it has a bushy tail, reddish brown along the center, with the terminal portion glossy black, but he was mistaken in supposing the animal to be larger than the Red Squirrel of the East (with which it agrees in size) and in crediting it with a "peculiarly cylindrical tail" (Mammals of North Am., 1857, 273–274). The tail, when full grown, is as flat as that of the members of the *Sciurus hudsonicus* group.

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* This river must not be confounded with another of the same name, a tributary of Bear River in southeastern Idaho.

Record of specimens collected of Sciurus richardsoni.

l l.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
17	1495	Lost River Mountains, Idaho.....	July 29, 1890	♂.....	330	133	51
11	1496	....do	....do	♀.....	284	121	50
16	1541	Birch Creek, Idaho	Aug. 6, 1890	♂.....	333	143	51
35	1581	....do	Aug. 11, 1890	♀.....	330	125	47
36	1582	....do	.. do	♂.....	333	120	50
19	145	.. do	....do	♂....	338	147	51
16	1612	Salmon River Mountains, Idaho	Aug. 19, 1890	♀ im .	257	82	48.5
11	1638	.. do	Aug. 23, 1890	♀.....	328	142	50
12	1672	.. do	Aug. 26, 1890	♀.....	342	140	51
13	1676	.. do	... do	♂ ad	345	130	51
10	1683	....do	... do	♂.....	319	124	51
03	1707	....do	Aug. 27, 1890	♂.....	352	148	51
05	1729	....do	Aug. 30, 1890	♂ ad..	325	124	52
04	1730	....do	.. do	♂ ad..	330	126	51
07	1774	....do	Sept. 5, 1890	♂.....	350	146	52
06	1775	....do	... do	♂....	340	130	52
17	170	....do	Aug. 18, 1890	♂.....	291	113	47
18	171	....do	....do	♀.....	308	123	50
36	178	. ..do	Aug. 22, 1890	♂.....	313	124	47
39	179	...do	....do	♂.....	326	127	48
38	180	....do	....do	♀.....	326	136	47
37	181	... do	....do	♀.....	211	128	47
06	1785	Pahsimeroi Mountains, Idaho.....	Sept. 14, 1890	♂.....	320	128	49
05	1797	....do	Sept. 15, 1890	♀.....	335	144	51
09	1798	....do	....do	♂ ad..	335	125	54
58	1799	....do	....do	♀.....	334	130	52
70	1800	....do	....do	♀...	325	133	51
71	1844	Head of Big Lost River, Idaho ..	Sept, 22, 1890	♀....	335	137	53
57	1855	Head of Wood River, Idaho.......	Sept. 25, 1890	♂ ad..	340	130	51
16	1862	Saw Tooth Lake, Idaho	Sept. 26, 1890	♀ im .	318	123	51
50	1863	...do	....do	♀ im .	315	126	51
17	1864	....do	....do	♀ ad..	330	136	51
51	1881	....do	Sept. 27, 1890	♂ ad..	342	138	53
19	1882	.. do	Sept. 28, 1890	♂ ad..	335	130	53
18	1895	....do	....do	♀ ad..	335	130	51

us volans sabrinus (Shaw). Hudsonian Flying Squirrel.

inus Shaw, Gen. Zoölogy, Mammalia, vol. II, part I, 1801, p. 157.

arge and handsome Flying Squirrels are common in the Salmon
l Saw Tooth Mountains and probably throughout the conifer-
s of Idaho. At Saw Tooth Lake Mr. Basil Hicks Dutcher
ree in traps set for marten (baited with birds and chipmunks).
light night in early October I heard one gnawing something
over our camp, and after nearly breaking my neck to secure
lly fired and brought down—not the squirrel, but a large hard
had stolen from our tent.

Record of specimens collected of Sciuropterus volans sabrinus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
24271	31675	1883	Saw Tooth Lake, Idaho...........	Sept. 28, 1890	♀ ad..	340	150	
24270	31674	1901	....do	Sept. 29, 1890	♂.....	310	138	
24378	31784	1913	....do	Sept. 30, 1890	♀ im .	325	145	

Castor canadensis Kuhl. Beaver.

Beavers are common in suitable places throughout Idaho. We found them on Timber Creek in the Salmon River Mountains, on the headwaters of the Pahsimeroi, and in the Saw Tooth Mountains. Fresh cuttings were observed also in Snake River Cañon near Shoshone Falls.

In 1872 several specimens were trapped in Teton Basin (skulls 12403 and 12404, U. S. Nat. Mus.).

Onychomys leucogaster brevicaudus subsp. nov. Idaho Grasshopper Mouse.

This new subspecies of Grasshopper Mouse is common in most parts of the Upper Sonoran zone of Idaho. It may be known by the following description:

ONYCHOMYS LEUCOGASTER BREVICAUDUS subsp. nov.

Type No. [illegible] ♂ ad. U. S. National Museum (Department of Agriculture collection). From Blackfoot, Idaho, July 15, 1890. Collected by Vernon Bailey and Basil Hicks Dutcher (original number 1442).

Measurements (taken in flesh).—Total length, 139; tail vertebræ, 38; hind foot, 19.5. Ear from crown, 12 (in dry skin).

General characters.—Similar to *O. leucogaster*, but smaller, with shorter tail and much larger ears. In the type specimen the ears are not quite so large as in all the other specimens from the same region.

Color.—Upper parts drab-gray, washed with pale cinnamon tawny, especially over the rump and flanks. Under parts and fore legs pure white, the white reaching well up on the sides, as usual in *Onychomys*. Tail whitish, with an ill-defined dark stripe on proximal two-thirds of upper surface. In immature, though full-grown, individuals the upper parts are mouse-gray, inclining to drab-gray, without the tawny wash.

Cranial and Dental characters.—Compared with *O. leucogaster* the skull is much smaller, the rostral part is both actually and relatively shorter, and the zygomatic arches are shorter and more spreading, particularly anteriorly, giving the postrostral part of the skull a squarish appearance. The last upper molar is smaller than in *leucogaster* and is cylindrical peg.

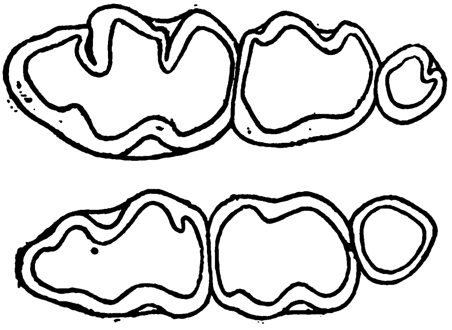

FIG. 2.—Teeth of *Onychomys brevicaudus* (type). Very much worn. × 15.

Record of specimens collected of Onychomys leucogaster brevicaudus.

.S. National useum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
kin.	Skull.							
107	30552	1422	Blackfoot, Idaho	July 11, 1890	♂	136	41	20
115	30560	1434	....do	July 13, 1890	♀	139	39	20
[illegible]	30532	1442	....do	July 15, 1890	♂	139	38	19.5
[illegible]	30531	1466	Big Lost River, Idaho	July 22, 1890	♂	135	41	19
[illegible]	30443	7	Blackfoot, Idaho	July 11, 1890	♀	134	34	18
[illegible]	30442	13	....do	July 12, 1890	♂	130	36	19.5
[illegible]	30515	30	....do	July 15, 1890	♂	132	37	19

esperomys crinitus sp. nov. Cañon Mouse.

This new species of *Hesperomys* belongs to the silky-haired *eremicus* oup of the Sonoran Province, the range of which is thus carried about miles north of its previously known limit. The present species is abundant inhabitant of the lava cañons of Snake River, where ghteen specimens were captured in a single night among the cliffs and asses of basalt at Shoshone Falls. Most of them were taken in traps ited with rolled oatmeal. The species may be known from the folwing description:

HESPEROMYS CRINITUS sp. nov.

Type No. [illegible] ♂ ad. U. S. National Museum (Department of Agriculture collec-). From Shoshone Falls, Snake River, Idaho, October 10, 1890. Collected by C. rt Merriam and Vernon Bailey (original number 1945).

Measurements (taken in flesh).—Total length, 175; tail vertebræ, 97; nd foot, 21; ear from notch, 21. In dry skin, ear from crown, 16.5; om notch, 18.5.

General characters.—Similar to *H. eremicus* in the peculiar silky texre of the pelage, but coloration much darker; hind feet and tail

shorter; tail densely haired, with hairs of distal third much elonga
In true *eremicus* the tail is nearly naked. Soles haired on posterior t
instead of entirely naked as in *eremicus*. Ears large. There is a p
of pale fulvous on the breast between the fore legs as in several of
subtropical forms of the genus. This patch is sometimes divided in
middle.

Color.—Upper parts pale olive-brown, heavily lined with blac
the back and rump, and strongly suffused with ochraceous buff on
sides. Under parts pure white, except the anal region and a patc
tween the fore legs, which are ochraceous buff. Tail sharply bic
dusky above, whitish below. In immature individuals the pale ful
pectoral and anal patches are indistinct, and in the very young they
absent.

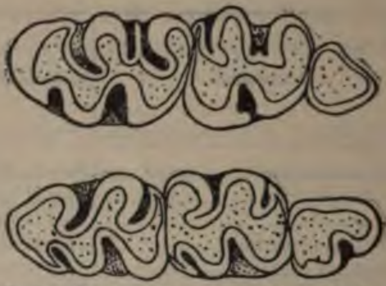

FIG. 3.—Teeth of *Hesperomys crinitus* ♂ old (type). × 15.

Record of specimens collected of Hesperomys crinitus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.
Skin.	Skull.						
24248	31652	1944	Shoshone Falls, Idaho	Oct. 10, 1890	♂ ad.	184	97
24255	31659	*1945	....do	....do	♂ ad.	175	97
24251	31655	1946	....do	....do	♂ ad.	173	95
24260	31664	1947	....do	....do	♂ ad.	172	94
24254	31658	1949	....do	....do	♂ ad.	174	93
24261	31665	1949	....do	....do	♂	167	90
24250	31654	1950	....do	....do	♂	172	95
24258	31662	1950	....do	....do	♂ im.	152	74
24253	31657	1952	....do	....do	♀ ad.	180	97
24249	31653	1953	....do	....do	♀	175	92
24252	31656	1954	....do	....do	♀	180	97
24257	31661	1955	....do	....do	♀ im.	165	88
24256	31660	1956	....do	....do	♀ im.	163	85

* Type.

eromys leucopus (Rafinesque). White-footed Mouse.

undant throughout the region traversed, occurring in equal num- from the Snake Plains to or above timber line on the mountains. species is one of the greatest nuisances the mammal collector has al with, as it is forever getting into traps set for more valuable ies. It inhabits all sorts of situations, and in most places far out- bers all other mammals together. When camped on Salmon River, ound Valley, the latter part of September, we saw dozens of them y night climbing about among the willows, and heard them rushing d fro among the dead leaves, making almost as much noise as its.

e large series of specimens here referred to this species may be d eventually to merit separation into two or three subspecies. largest and handsomest form is the one from the Saw Tooth ntains, which is nearly identical with that from the Salmon River ntains. In these the tail is sharply bicolor, blackish above and white below. Specimens from the sage plains and valleys have ail indistinctly bicolor. Those from the cañon of Snake River are ler and differ somewhat in coloration.

Record of specimens collected of Hesperomys leucopus.

National um No. Skull.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
30562	1	Blackfoot, Idaho	July 10, 1890	♀	175	75	21
30561	2	do	do	♀	160	68	19.5
30564	1417	do	do	♀	177	74	19
30554	1418	do	do	♀	170	77	19.5
30558	8	do	July 11, 1890	♀	169	70	20
30550	9	do	do	♂	168	74	20
30557	10	do	do	♀	130	57	19.5
30448	11	do	do	♂	129	57	19
30555	1421	do	do	♂	147	68	20
30556	12	do	July 12, 1890	♀	113	48	18
30563	1428	do	do	♀	178	81	20
30551	1429	do	do	♀	171	80	20
30559	1430	do	do	♂	165	80	20
30553	18	do	July 13, 1890	♀	180	81	20
....	19	do	do	♂	150	67	19
30523	31	do	July 15, 1890	♂	151	69	19
30517	1453	Big Butte, Idaho	July 19, 1890	♀ ad.	182	80	20.5
30524	1454	do	do	♀ im.	117	51	19
30522	45	Big Lost River, Idaho	July 22, 1890	♂	168	75	21
30527	1468	do	do	♀	166	67	20
30525	1469	do	do	♀	173	76	20
30519	1470	do	do	♀	177	80	20
30528	1471	do	do	♀	170	74	21
30520	1472	do	do	♀	179	80	21
30516	1473	do	do	♀	158	72	20
30529	1474	do	do	♀	182	71	20.5

Record of specimens collected of Hesperomys leucopus—Continued.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23914	31319	1475	Big Lost River, Idaho	July 22, 1890	♀	153	70	21
23072	30518	1476	...do	...do	♂	168	78	21
23080	30526	1477	...do	...do	♂	162	72	20.5
23084	30530	1478	...do	...do	♂	151	68	19
23068	30514	1479	...do	...do	♂	160	73	20
23075	30521	52	...do	July 23, 1890	♂	165	73	20
23913	31318	1488	...do	July 24, 1890	♀	184	89	20
23912	31317	56	...do	...do	♀	174	72	21
23247	30704	1492	Arco, Idaho	July 26, 1890	♀ ad	176	76	20
23338	30797	1550	Birch Creek, Idaho	Aug. 7, 1890	♀	165	72	20.5
23335	30794	1557	...do	...do	♂	155	63	20
23339	30798	1558	...do	...do	♂	180	85	20
23341	30800	1566	...do	...do	♀	170	78	21
23343	30802	1567	...do	Aug. 8, 1890	♀	188	88	21
23342	30801	1568	...do	...do	♀	169	76	20
23555	30973	1571	...do	Aug. 9, 1890	♀	156	66	19.5
23554	30972	1572	...do	...do	♂	151	68	21
23337	30796	132	...do	...do	♂	160	73	21
23336	30795	133	...do	...do	♂	154	70	20
23340	30799	134	...do	...do	♀	140	60	20
23345	30804	135	...do	...do	♂	116	55	18
23344	30803	1579	...do	Aug. 10, 1890	♀	133	61	21
....	....	1635	Salmon River Mountains, Idaho	Aug. 23, 1890	♂	173	80	22
23549	30967	1636	...do	...do	♂	147	62	21
23551	30969	1644	...do	...do	♂	152	68	20
23679	31073	1658	...do	Aug. 25, 1890	♀	170	75	20
23553	31971	1659	...do	...do	♂	162	72	20
23548	30966	1660	...do	...do	♀	174	77	20
23552	30970	1661	...do	...do	♀	150	67	19.5
23678	31072	1662	...do	...do	♂ im	150	63	20
23556	30974	1673	...do	Aug. 26, 1890	♀ ad	160	68	19.5
23828	31228	1702	...do	Aug. 27, 1890	♀ ad	170	70	19.5
23830	31230	1715	...do	Aug. 29, 1890	♀ ad	165	73	20
23829	31229	1716	...do	...do	♀ im	131	57	19.5
23827	31227	1717	...do	...do	♀ ad	160	75	21
23833	31233	1726	...do	Aug. 30, 1890	♂ im	148	66	20
23831	31231	1727	...do	...do	♀	158	66	20
23832	31232	1728	...do	...do	♂ im	131	59	18
23825	31225	1749	Lemhi Indian Agency, Idaho	Sept. 2, 1890	♂	170	79	21
23824	31224	1750	...do	...do	♂	170	80	21
23820	31220	1751	...do	...do	♂	158	71	20
23823	31223	1752	...do	...do	♂	165	74	21
24303	31707	1753	...do	...do	♂	151	70	20
23821	31221	1754	...do	...do	♀	163	75	20
23822	31222	1767	...do	Sept. 3, 1890	♂	175	83	21
23826	31226	1768	...do	...do	♂	166	76	22
23911	31315	1794	Pahsimeroi Mountains, Idaho	Sept. 15, 1890	♂	156	72	20
23910	31314	1795	...do	...do	♀	166	77	20
25073	....	1874	Saw Tooth Lake, Idaho	Sept. 27, 1890	♂	180	88	21
24043	31459	1875	...do	...do	♀	187	85	21
24042	31458	1886	...do	Sept. 28, 1890	♀	172	79	22

Record of specimens collected of Hesperomys leucopus—Continued.

National seum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
ı.	Skull.							
11	31457	1887	Saw Tooth Lake, Idaho	Sept. 28, 1890	♀	165	78	20
14	31460	1888	do	do	♂	155	67	20.5
10	31456	1908	do	Sept. 29, 1890	♂ im.	144	62	21
38	31794	1922	do	Oct. 2, 1890	♂ ad.	178	84	22
19	31795	1923	do	do	♂	175	85	22.5
17	31793	1924	do	do	♂	175	89	22.5
35	31791	1925	do	do	♀	173	84	22.5
10	31796	1926	do	do	♀	185	89	22
50	31663	1940	do	Oct. 4, 1890	♂ ad.	176	88	22.5
36	31670	1957	Shoshone Falls, Idaho	Oct. 10, 1890	♂ ad.	157	71	20
34	31668	1958	do	do	♀	156	65	19
35	31669	1959	do	do	♂	150	70	20.5
33	31667	1960	do	do	♀ im.	145	65	19
32	31666	1961	do	do	♂ im.	144	62	19

toma cinerea (Ord). Bushy-tailed Wood Rat.

us cinereus Ord, Guthrie's Geography, 2d Am. Ed. II, 1815, 292" (Based on the description of Lewis and Clark, Paul Allen ed., 1814, vol. I, pp. 289–290; type from Great Falls, Montana).

ommon in the cliffs of Birch Creek Valley and in a cañon in the Lost er Mountains. One was caught on a *Lagomys* slide at timber line in Pahsimeroi Mountains, September 16, in a trap set on a stack of *omys* hay.

Record of specimens collected of Neotoma cinerea.

National seum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
ı.	Skull.							
70	31064	163	Birch Creek, Idaho	Aug. 14, 1890	♂	400	175	47
58	31062	1603	do	Aug. 16, 1890	♀	380	163	40
16	31060	1600	do	Aug. 15, 1890	♂	382	163	42
19	31063	164	do	Aug. 14, 1890	♂	365	155	46
57	30975	1597	do	do	♂	378	165	47
57	31061	1601	do	Aug. 15, 1890	♀	317	142	39
58	30976	1602	do	do	♀	327	144	39
20	30779	1526	Lost River Mountains, Idaho	Aug. 1, 1890	♀	405	182	45
21	30780	1525	do	do	♂	397	176	48
23	30781	1524	do	do	♂	370	165	45
9	30778	1504	do	July 30, 1890	♂	332	145	44
8	30777	1527	do	Aug. 1, 1890	♀	306	136	42
0	31466	1815	Pahsimeroi Mountains, Idaho	Sept. 16, 1890	♀	315	100	43

Neotoma cinerea occidentalis Baird. Dusky Wood Rat.

Neotoma occidentalis (Cooper MS.) Baird, Proc. Acad. Nat. Sci. Phila., 1855, 335 (type from Shoalwater Bay, Washington).

Abundant in the black lava cañon of Snake River and in the lava beds throughout the Snake Plains. The darkest individuals were caught at Big Butte and Shoshone Falls and are considerably blacker than the type of *occidentalis* from the Pacific Coast. Specimens from lava cliffs on the Lemhi Indian Agency are referable to this form and probably came by way of Salmon River and the lower Lemhi.

The ranges of the light (*cinerea*) and dark (*occidentalis*) Bushy-tailed Wood Rats meet in Idaho, the former occupying the higher levels and extending eastward throughout the Rocky Mountain region to the Black Hills of South Dakota; the latter inhabiting the Snake Plains and reaching westward to the Pacific.

Record of specimens collected of Neotoma cinerea occidentalis.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
24557	31952	1967	Shoshone Falls, Idaho	Oct. 11, 1890	♀	355	152	43
23920	31325	1455	Big Butte, Idaho	July 19, 1890	♂	390	170	46
23919	31324	1458	....do	July 20, 1890	♀ im.	295	98	39
23323	30782	1493	Arco, Idaho	July 26, 1890	♂ ad.	386	176	48
24049	31465	1758	Lemhi Indian Agency, Idaho	Sept. 3, 1890	♂	397	164	43
24048	31464	1756	....do	....do	♂	404	178	45
23803	31203	1757	....do	....do	♀	353	150	42
23905	31309	1739	....do	Sept. 2, 1890	♀	337	147	40
23904	31308	1748	....do	....do	♀	350	158	42
24272	31676	1841	Challis, Idaho	Sept. 20, 1890	♂	380	160	45
....	31709	1750	Lemhi Indian Agency, Idaho	Sept. 3, 1890	♀	......	......	......

Arvicola riparius Ord. Common Arvicola.

In Idaho this species is common in wet meadows in the Neutral and Douglas fir zones, where 40 specimens were collected. It was found in greatest abundance in Birch Creek and Lemhi Valley, Round or Challis Valley, and along the base of the Salmon River and Lost River Mountains. The species seems to be identical with typical *A. riparius* of the Atlantic States, and the postero-internal prism of the middle upper molar is as strongly developed as in the eastern animal (see Plate II, Fig. 1).

Two specimens (Nos. 24014, from Saw Tooth Lake, and 24020, from Salmon River near Challis) included in the following table are not true *riparius* and may belong to some other species.

Record of specimens collected of Arvicola riparius.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23375	30835	91	Birch Creek, Idaho	Aug. 4, 1890	♂	174	49	20
23373	30833	92	...do	...do	♂	172	42	21
23374	30834	93	...do	...do	♀	162	45	20
23386	30846	94	...do	...do	♂	139	38	20.5
23385	30845	95	...do	...do	♀	128	33	19
23384	30844	97	...do	...do	♂	140	42	20
23380	30840	103	...do	Aug. 6, 1890	♂	132	42	20
23363	30822	105	...do	...do	♂	124	31	18
23376	30836	108	...do	...do	♂	......	......	......
23381	30841	1538	...do	...do	♂	184	51	20.5
23383	30843	1539	...do	...do	♀	156	41.5	19.5
23377	30837	118	...do	Aug. 6, 1890	♂	170	42	19.5
23387	30847	119	...do	...do	♂	139	37	18.5
23379	30839	123	...do	...do	♂	148	35	21
23362	30821	127	...do	Aug. 8, 1890	♀	132	35	19
23378	30838	128	...do	...do	♂	136	35	19
23511	30929	1632	Salmon River Mountains, Idaho	Aug. 23, 1890	♂	160	48	21
23513	30931	1649	...do	Aug. 24, 1890	♀	131	33	18
23382	30842	1552	Birch Creek, Idaho	Aug. 8, 1890	♀	146	42	19
23484	31288	1764	Lemhi Indian Agency, Idaho	Sept. 3, 1890	♂	154	36	21.5
24021	31437	1836	Challis, Idaho	Sept. 20, 1890	♂ ad.	158	43	21.5
24018	31434	1837	...do	...do	♀ ad.	174	49	21
24017	31433	1835	...do	...do	♂ ad.	154	42	21
23246	30703	84	Lost River Mountains, Idaho	July 31, 1890	♂ im.	128	35	19
23358	30817	96	Birch Creek, Idaho	Aug. 4, 1890	♂ im.	116	32	19
23360	30819	1578	...do	Aug. 10, 1890	♂ im.	114	34	18
23359	30818	120	...do	Aug. 6, 1890	♂ im.	116	29	18.5
23372	30832	124	...do	Aug. 8, 1890	♂ im.	137	37	19.5
23364	30823	125	...do	...do	♂ im.	133	30	18
23361	30820	126	...do	...do	♀ im.	116	31	18
23388	30848	104	...do	Aug. 5, 1890	♂	142	40	20
24031	31447	1830	Salmon River, Idaho	Sept. 19, 1890	♂	132	38	20
24020	31436	1829	Challis, Idaho	...do	♀ ad.	160	37	19
24014	31430	1891	Saw Tooth Lake, Idaho	Sept. 28, 1890	♂	174	45	21
24027	31443	1833	Challis, Idaho	Sept. 19, 1890	♂ juv.	118	32	19
24028	31444	1832	...do	...do	♀ juv.	116	29	18.5
24029	31445	1838	...do	Sept. 20, 1890	♂ juv.	120	32	19
24030	31446	1834	...do	Sept. 19, 1890	♀ juv.	116	30	18.5
24032	31448	1831	...do	...do	♂ juv.	120	32	19
24034	31450	1839	...do	Sept. 20, 1890	♂ juv.	122	32	18

Arvicola macropus sp. nov. Big-footed Arvicola.

This new Arvicola is the largest species thus far known from North America with the single exception of *Arvicola* (*Neofiber*) *alleni* from Florida. It is abundant in the Salmon River, Saw Tooth, and Pahsimeroi Mountains and probably throughout the mountain regions of central and northern Idaho, inhabiting wet meadows and springy places in the higher parks from timber line down to the bottom of the Canadian or Douglas fir zone. Its only near relative is *A. townsendi* from the Pacific coast region, with which it may be found to intergrade in the forests north of the Plains of the Columbia. It may be known from the following description:

ARVICOLA (MYNOMES) MACROPUS sp. nov.

Type No. [illegible] ♀ ad. U. S. National Museum (Department of Agriculture collection). From Pahsimeroi Mountains, Idaho, September 16, 1890. Collected by C. Hart Merriam and Vernon Bailey. (Original number 1803.)

Measurements (taken in flesh).—Total length, 220; tail vertebræ, 71; pencil, 7; hind foot, 26. (Dry skin) Ear from crown, 8; from notch, 12.

General characters.—Largest *Arvicola* known from North America except *A. (Neofiber) alleni* from Florida. Similar to *A. townsendi*, but larger with larger hind feet, much longer hallux, and upper incisors much more prominent. In *A. townsendi*, as pointed out by Baird, the tip of the claw of the first toe of the hind foot barely reaches the notch between the second and third toes, while in *A. macropus* the first toe without the claw reaches the same point. Fur very long, soft, and almost woolly. Ears large, showing above fur.

Color.—Upper parts grayish bister, lined with black-tipped hairs, and palest on the sides. Under parts pale ash gray, the plumbeous basal fur showing through. Tail, bicolor without sharp line of demarkation: dusky above, whitish below. Ankles blackish. Feet dusky (hind toes sometimes much lighter than rest of foot). The white around the mouth is not so pronounced as in *A. townsendi.*

Cranial and Dental characters as in most of the western members of the subgenus or section *Mynomes*—the western species, as is well known, usually lacking the postero-internal lobe or spur of the middle upper molar. Not having a perfect skull of *A. townsendi* before me I am unable to point out cranial differences.

Record of specimens collected of Arvicola macropus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23681	31075	1627	Salmon River Mountains, Idaho	Aug. 23, 1890	♀	184	55	25.5
23682	31076	1628	....do	...do	♂	205	67	28
23686	31080	1629	....do	...do	♂	185	61	26
23684	31078	1630	....do	...do	♂	188	66	26
23685	31079	1631	....do	...do	♀	170	52	25
23680	31074	1650	....do	Aug. 24, 1890	♀	162	49	25
23688	31082	1666	....do	Aug. 25, 1890	♀ im.	165	53	24
23687	31081	1667	....do	...do	♂	174	54	26
23689	31083	1668	....do	...do	♂	165	66	25
23683	31077	1669	....do	Aug. 26, 1890	♂ ad.	173	57	26
23857	*31257*	1719	....do	Aug. 29, 1890	♂ ad.	176	55	26

Record of specimens collected of Arvicola macropus—Continued.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23888	31292	1781	Pahsimeroi Mountains, Idaho	Sept. 14, 1890	♂	195	65	28
23885	31289	1802	....do	Sept. 15, 1890	♂	180	60	27
23887	31291	*1803	....do	Sept. 16, 1890	♀ ad	220	71	26
23886	31290	1804	....do	...do	♀	180	57	25
23891	31295	1805	....do	...do	♀	178	57	25
23889	31293	1806	....do	...do	♀	178	55	24, 5
24628	32023	1807	....do	...do	♂ ad	202	68	28
23890	31294	1808	....do	...do	♀	186	58	26
24232	31636	1849	Summit, Alturas County, Idaho	Sept. 23, 1890	♂	190	64	26
24235	31639	1856	Head of Wood River, Idaho	Sept. 25, 1890	♀ ad	245	73	26
24226	31630	1857	....do	...do	♂	200	63	26
24035	31451	1876	Saw Tooth Lake, Idaho	Sept. 27, 1890	♀ ad	242	79	26
24228	31632	1877	....do	...do	♀ im	168	51	26
24238	31642	1878	....do	...do	♂ im	128	40	23
24015	31431	1879	....do	...do	♂ im	132	38	23
24023	31439	1880	....do	...do	♂ im	142	42	24
24227	31631	1884	....do	Sept. 28, 1890	♂ ad	205	70	27
24016	31432	1885	....do	...do	♀	162	58	21
24229	31633	1896	....do	...do	♂	174	53	26
24225	31629	1899	....do	Sept. 29, 1890	♂ ad	195	68	26
24230	31634	1900	....do	...do	♀ im	190	63	26
24401	31807	1911	....do	Sept. 30, 1890	♀	185	63	27
24399	31805	1921	....do	Oct. 2, 1890	♀	184	62	27

* Type.

Arvicola mordax sp. nov. Cantankerous Arvicola.

This new Arvicola is common in the marshes bordering the inlet of Saw Tooth or Alturas Lake at the east foot of the Saw Tooth Mountains, and specimens were collected also in the Lembi Indian Agency, Salmon River Mountains, Lost River Mountains, and at the north foot of the Brunneau Mountains. Thirty-five specimens were secured.

Its nearest relative seems to be *A. longicaudus* of the Black Hills of Dakota, but it differs from *longicaudus* in having a still longer tail, larger hind feet, and much smaller ears, and also in cranial characters and coloration. It may be known from the following description:

ARVICOLA (MYNOMES) MORDAX sp. nov.

Type No. $\frac{24224}{31635}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Saw Tooth or Alturas Lake, east foot of Saw Tooth Mountains, Idaho, September 29, 1890. Collected by C. Hart Merriam and Vernon Bailey (original number 1903).

Measurements (taken in flesh).—Total length, 200; tail vertebræ, 77; hairs, 6; hind foot, 22; ear (in dry skin) from crown, 10; from notch, 13.

General characters.—Similar to *A. longicaudus* but larger, with larger hind feet, longer tail, and smaller ears; color of upper parts paler; feet and under sides of tail whitish instead of dusky; ears nearly naked, slightly overtopping the fur; hind legs naked for some distance above ankles.

Color.—Upper parts pale grayish bister, conspicuously lined with black-tipped hairs, and becoming almost clear gray on the sides. Under parts and feet whitish, the plumbeous basal fur showing through slightly. Tail bicolor; dark above, whitish below. The gray of the sides fades gradually into the white of the belly. Some specimens have a rusty tinge on the back. This is most pronounced in No. 23371 from the Lost River Mountains.

Cranial and Dental characters.—Skull similar to that of *A. longicaudus* but with processes and ridges more strongly developed; nasal bones longer and less depressed anteriorly, and audital bullæ more inflated. The condyloid ramus of the jaw is longer and more vertical than in *longicaudus*, and the angular process is longer. The teeth are as in *A. longicaudus* (see Plate II, Figs. 3, 4).

Record of specimens collected of Arvicola mordax.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
26240	31644	1890	Saw Tooth Lake, Idaho	Sept. 28, 1890	♂	180	67	23
24241	31645	1893	....do	....do	♂	182	65	22
24024	31440	1894	....do	....do	♂ im.	156	55	21
24025	31441	1897	....do	....do	♂ im.	152	53	21
24231	31635	*1903	....do	Sept. 29, 1890	♂ ad.	200	77	22
24013	31429	1904	....do	....do	♂	180	63	22
24012	31428	1905	....do	....do	♀ ad.	181	63	23
24019	31435	1906	....do	....do	♀ im.	156	56	21
24033	31449	1910	....do	....do	♂	160	60	21
24398	31804	1916	....do	Sept. 30, 1890	♀ ad.	174	63	
24237	31641	1935	....do	Oct. 4, 1890	♂	160	55	
24234	31638	1938	....do	....do	♀ ad.	174	62	
24233	31637	1939	....do	....do	♀	154	55	
24554	31949	1970	Three Creek, Idaho	Oct. 14, 1890	♂	178	60	
23245	30702	1519	Lost River Mountains, Idaho	July 31, 1890	♂	180	69	
23371	30831	1623	....do	Aug. 1, 1890	♂	162	61	
23860	31260	1740	Lemhi Indian Agency, Idaho	Sept. 2, 1890	♀	168	58	
23861	31261	1769	....do	Sept. 4, 1890	♂ ad.	180	63	
24026	31442	1907	Saw Tooth Lake, Idaho	Sept. 29, 1890	♀ juv.	136	46	
24236	31640	1934	....do	Oct. 3, 1890	♀ juv.	144	4	
24239	31643	1937	....do	Oct. 4, 1890	♀ juv.	145	4	
23512	30930	1633	Salmon River Mountains, Idaho	Aug. 23, 1890	♀ juv.	146	5	
23859	31259	1741	Lemhi Indian Agency, Idaho	Sept. 2, 1890	♂ juv.	121	4	
23858	31258	1765	....do	Sept. 3, 1890	♂ juv.	149		
24022	31438	1892	Saw Tooth Lake, Idaho	Sept. 28, 1890	♂ juv.	114		

* Type.

Arvicola nanus sp. nov. Dwarf Arvicola.

A dozen specimens of this new Arvicola were trapped on hillside in the Pahsimeroi Mountains at an elevation of abo feet). The species was not met with elsewhere.

ARVICOLA (MYNOMES) NANUS sp. nov.

Type No. $\frac{23853}{31253}$ ♂ ad. U. S. National Museum (Department of Agriculture collection). From Pahsimeroi Mountains, Idaho (altitude 2,850 meters or 9,350 feet), September 16, 1890. Collected by C. Hart Merriam and Vernon Bailey (original number 1809).

Measurements (taken in flesh).—Total length, 151; tail vertebræ, 41; hairs, 7.5; hind foot, 18. Ear (in dry skin) from crown, 4; from notch, 9.5.

General characters.—Size, small; one of the smallest species known from North America. Ears, small, suborbicular, with large antitragus and large fossa innominata; upper margin incurved; posterior margin sparsely haired. Whiskers short, barely reaching meatus. Hind feet short. Tail slightly more than one-third the length of head and body; well haired, and penicillate.

Color.—Upper parts pale grizzled bister, conspicuously mixed with black-tipped hairs, and becoming ash gray on the sides. Under parts grayish white. Tail bicolor; above dusky, below whitish. Feet dusky.

Cranial and Dental characters.—Skull very small; basilar length of Hensel, 22; zygomatic breadth, 14. Muscular impressions strongly developed; brain case narrow and high; jugal bones parallel; parietals sub-truncate anteriorly; nasals ending about on plane of nasal branch of premaxillary; length of incisive foramina less than twice the premaxillary symphyses. Teeth as usual in western *Mynomes*, normally lacking the postero-internal loop or spur of middle upper molar (in one specimen out of the twelve there is an attempt at this loop).

Record of specimens collected of Arvicola nanus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23881	31285	1782	Pahsimeroi Mountains, Idaho	Sept. 14, 1890	♀	135	35	18
23883	31287	1783	....do	...do	♂	140	37	19
23880	31284	1784	....do	....do	♀ im.	115	32	18
23882	31286	1789	....do	Sept. 15, 1890	♂	144	38	19
23853	31253	*1809	....do	Sept. 16, 1890	♀	151	41	18
23852	31252	1810	....do	....do	♂	130	35	18
23851	31251	1811	....do	....do	♀	130	32	18
23854	31254	1812	....do	....do	♀	125	32	18
23870	31283	1790	....do	Sept. 15, 1890	♂ juv.	97	23	17
23876	31280	1791	....do	....do	♂ juv.	105	31	17
23878	31282	1792	....do	....do	♂ juv.	98	24	16.5
23877	31281	1793	....do	....do	♀ juv.	104	27	17
23855	31255	1813	....do	Sept. 16, 1890	♀ juv.	118	29	17
24555	31950	1968	Three Creek, Idaho	Oct. 13, 1890	♂	142	40	21
24553	31948	1969	....do	....do	♂	150	43	20
24556	31951	1971	....do	Oct. 14, 1890	♂ im.	138	39	19

*Type.

slightly overtopping the fur; hind legs naked for some distance above ankles.

Color.—Upper parts pale grayish bister, conspicuously lined with black-tipped hairs, and becoming almost clear gray on the sides. Under parts and feet whitish, the plumbeous basal fur showing through slightly. Tail bicolor; dark above, whitish below. The gray of the sides fades gradually into the white of the belly. Some specimens have a rusty tinge on the back. This is most pronounced in No. 23371 from the Lost River Mountains.

Cranial and Dental characters.—Skull similar to that of *A. longicaudus* but with processes and ridges more strongly developed; nasal bones longer and less depressed anteriorly, and audital bullæ more inflated. The condyloid ramus of the jaw is longer and more vertical than in *longicaudus*, and the angular process is longer. The teeth are as in *A. longicaudus* (see Plate II, Figs. 3, 4).

Record of specimens collected of Arricola mordax.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
26240	31644	1890	Saw Tooth Lake, Idaho.	Sept. 28, 1890	♂	180	67	23
24241	31645	1893	....do	....do	♂	182	65	22
24024	31440	1894	....do	....do	♂ im.	156	55	21
24025	31441	1897	....do	....do	♂ im.	152	53	21
24231	31635	*1903	....do	Sept. 29, 1890	♂ ad.	200	77	22
24013	31429	1904	....do	....do	♂	180	63	22
24012	31428	1905	....do	....do	♀ ad.	181	63	22
24019	31435	1906	....do	....do	♀ im.	156	56	21
24033	31449	1910	....do	....do	♂	160	60	21
24398	31804	1916	....do	Sept. 30, 1890	♀ ad.	174	63	21
24237	31641	1935	....do	Oct. 4, 1890	♂	160	55	22
24234	31638	1938	....do	....do	♀ ad.	174	62	22.5
24233	31637	1939	....do	....do	♀	154	55	22
24554	31949	1970	Three Creek, Idaho.	Oct. 14, 1890	♂	178	60	21
23245	30702	1519	Lost River Mountains, Idaho	July 31, 1890	♂	180	69	21
23371	30831	1623	....do	Aug. 1, 1890	♂	162	61	20.5
23860	31260	1740	Lemhi Indian Agency, Idaho	Sept. 2, 1890	♀	168	58	21
23861	31261	1769	....do	Sept. 4, 1890	♂ ad.	180	63	20.5
24026	31442	1907	Saw Tooth Lake, Idaho.	Sept. 29, 1890	♀ juv.	136	46	20
24236	31640	1934	....do	Oct. 3, 1890	♀ juv.	144	45	21
24239	31643	1937	....do	Oct. 4, 1890	♀ juv.	145	49	22
23512	30930	1633	Salmon River Mountains, Idaho	Aug. 23, 1890	♀ juv.	146	51	21
23859	31259	1741	Lemhi Indian Agency, Idaho	Sept. 2, 1890	♂ juv.	121	40	19
23858	31258	1765	....do	Sept. 3, 1890	♂ juv.	149	49	20.5
24022	31438	1892	Saw Tooth Lake, Idaho	Sept. 28, 1890	♂ juv.	114	38	19

* Type.

Arvicola nanus sp. nov. Dwarf Arvicola.

A dozen specimens of this new Arvicola were trapped on a grassy hillside in the Pahsimeroi Mountains at an elevation of about 2,850 meters (9,350 feet). The species was not met with elsewhere.

ARVICOLA (MYNOMES) NANUS sp. nov.

ype No. [illegible] ♂ ad. U. S. National Museum (Department of Agriculture collection). From Pahsimeroi Mountains, Idaho (altitude 2,850 meters or 9,350 feet), September 16, 1890. Collected by C. Hart Merriam and Vernon Bailey (original number 1809).

easurements (taken in flesh).—Total length, 151; tail vertebræ, 41; s, 7.5; hind foot, 18. Ear (in dry skin) from crown, 4; from notch,

eneral characters.—Size, small; one of the smallest species known ı North America. Ears, small, suborbicular, with large antitra and large fossa innominata; upper margin incurved; posterior gin sparsely haired. Whiskers short, barely reaching meatus. d feet short. Tail slightly more than one-third the length of head body; well haired, and penicillate.

lor.—Upper parts pale grizzled bister, conspicuously mixed with k-tipped hairs, and becoming ash gray on the sides. Under parts ish white. Tail bicolor; above dusky, below whitish. Feet dusky.

ranial and Dental characters.—Skull very small; basilar length of sel, 22; zygomatic breadth, 14. Muscular impressions strongly eloped; brain case narrow and high; jugal bones parallel; parie sub-truncate anteriorly; nasals ending about on plane of nasal ch of premaxillary; length of incisive foramina less than twice the axillary symphyses. Teeth as usual in western *Mynomes*, nory lacking the postero-internal loop or spur of middle upper molar ne specimen out of the twelve there is an attempt at this loop).

Record of specimens collected of Arvicola nanus.

National eum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
	Skull.							
1	31285	1782	Pahsimeroi Mountains, Idaho	Sept. 14, 1890	♀	135	35	18
3	31287	1783	....do	... do	♂	140	37	19
0	31284	1784	....do	....do	♀ im.	115	32	18
2	31286	1789	....do	Sept. 15, 1890	♂	144	38	19
3	31253	*1809	....do	Sept. 16, 1890	♀	151	41	18
2	31252	1810	....do	....do	♂	130	35	18
1	31251	1811	....do	....do	♀	130	32	18
4	31254	1812	....do	....do	♀	125	32	18
9	31283	1790	....do	Sept. 15, 1890	♂ juv.	97	23	17
6	31280	1791	....do	....do	♂ juv.	105	31	17
8	31282	1792	....do	....do	♂ juv.	98	24	16.5
7	31281	1793	....do	....do	♀ juv.	104	27	17
5	31255	1813	....do	Sept. 16, 1890	♀ juv.	118	29	17
5	31950	1968	Three Creek, Idaho	Oct. 13, 1890	♂	142	40	21
3	31948	1969	....do	....do	♂	150	43	20
6	31951	1971	....do	Oct. 14, 1890	♂ im.	138	39	19

*Type.

PHENACOMYS OROPHILUS sp. nov.

Type No. $\frac{23856}{31256}$ ♀ ad. U. S. National Museum (Department of Agriculture collection). From Salmon River Mountains, Idaho (near head of Timber Creek, altitude 3,200 meters or 10,500 feet), August 28, 1890. Collected by C. Hart Merriam and Vernon Bailey. (Original number 1710.)

Measurements (taken in flesh).—Total length, 146; tail vertebræ, 38; pencil, 3; hind foot, 19. Ear from crown, 10; from notch, 13 (in dry skin).

General characters.—Size a little larger than *Phenacomys intermedius*; ears large and conspicuous; tail small and cylindrical. Whiskers short, hardly reaching to ears. Ground color gray as in *Arvicola pallidus*, but darker along the back.

Color.—Upper parts gray, tinged with buffy and heavily lined with black-tipped hairs, particularly along the middle of the back. Under parts whitish, the plumbeous basal fur showing through. Tail bicolor, its upper and lower surfaces concolor with the corresponding surfaces of the body.

Cranial and Dental characters.—Skull low, broad, and flat, apparently much as in *P. intermedius.* Frontal sulcus shallow. Interparietal narrowly pentagonal as in *P. latimanus* (very different from that of *P. celatus*). Teeth only half-rooted, growing from persistent pulps except (probably) in extreme old age.* The general pattern of the crowns of the teeth is similar to that in *P. celatus* except that the outer loops of the last upper molar are very much reduced, and the posterior loop of the last lower molar is smaller, making this tooth of approximately equal breadth at both ends (see Plate III, Figs. 3, 4).

Record of specimens collected of Phenacomys orophilus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23850	31250	1684	Salmon River Mountains, Idaho ..	Aug. 27, 1890	♀ ad ..	......	30	17
23856	31256	1710	....do	Aug. 28, 1890	♀ ad ..	146	38	19
23842	31242	1713	....do	Aug. 29, 1890	♂	112	25	17
23849	31249	1772	....do	Sept. 5, 1890	♂ ad ..	120	28	19
....	31947	....	Saw Tooth Mountains, Idaho	Sept. 30, 1890	....	.....	......	......

Evotomys idahoensis sp. nov. Idaho Red-backed Mouse.

Red-backed mice of the genus *Evotomys* are common in the coniferous forests of the Boreal zone in Idaho. Six specimens were secured, three in the Salmon River Mountains and three in the Saw Tooth Mountains. They were usually caught in traps set under rotten logs in dry pine or spruce woods, though Mr. Bailey caught one in his hands ie daytime as it was drinking at the margin of Saw Tooth Lake, ıber 3 (No. 24282). There was snow on the ground at the time.

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* This is the case also in *P. longicaudus*, the type specimen of which I have had the privilege of examining, through the courtesy of Mr. True.

hile agreeing in a general way, those from the Salmon River Mouns are smaller, have shorter feet and tails, relatively longer ears, and much larger antitragus than those from the Saw Tooth Mountains, the nasal bones are noticeably shorter. Should these differences e constant the two forms will require separation. The Saw Tooth ntain animal is the one here described.

EVOTOMYS IDAHOENSIS sp. nov.

(Teeth, Plate III, Figs. 5, 6.)

'ype No. [illegible] ♀ ad. U. S. National Museum (Department of Agriculture collection). From Saw Tooth or Alturas Lake, east foot of Saw Tooth Mountains, Idaho, October 4, 1890. Collected by C. Hart Merriam and Vernon Bailey (Original number 1936).

easurements (taken in flesh).—Total length, 153; tail vertebræ, 48; il, 6.5; hind foot, 20. Ear from crown, 10; from notch, 12.5 (in dry).

neral characters.—Size and proportions about as in *E. galei* from mountains of Boulder County, Colorado; smaller than *E californi*- coloration unique, a well-defined, pale hazel dorsal area as in *galei*, ash gray sides as in *californicus*.

lor.—Dorsal area hazel, well defined, darker than in *galei* but not right as in *gapperi*; rest of upper parts dark ash gray tinged with r as in *californicus*, not suffused with ochraceous buff as in *gapperi galei*. Under parts soiled whitish, the plumbeous basal color of fur showing through. Tail indistinctly bicolor, dusky above, much r below.

ranial and Dental characters.—Skull rather narrow, as in *gapperi* and *lentalis*, with the nasals less strongly deflexed and the frontals narr interorbitally. The last upper molar has three deep reëntrant es and four salient angles or loops on each side with a tendency to a fifth on the outer side. The first lower molar has five projectloops and four deep reëntrant angles on the inner side and four ecting loops and three deep reëntrant angles on the outside. The lower molar is slightly broader anteriorly than posteriorly.

Record of specimens collected of Evotomys idahoensis.

National seum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
.	Skull.							
3	31687	*1936	Saw Tooth Lake, Idaho	Oct. 4, 1890	♀ ad.	153	48	20
2	31686	1931	....do	Oct. 3, 1890	♂	138	42	20
2	31798	1920	....do	Oct. 2, 1890	♀ im.	128	38	19
0	31240	1732	Salmon River Mountains, Idaho.	Aug. 31, 1890	♂ im.	115	32	18.5
1	31241	1712	....do	Aug. 29, 1890	♀ ad.	145	40	19
0	31313	1701	....do	Aug. 27, 1890	♀ ad.	142	37	19

* Type.

Fiber zibethicus (Linnæus). Muskrat.

Muskrats are common in Lemhi River and in most of the streams and beaver ponds of Idaho. We found them particularly abundant at Saw Tooth or Alturas Lake, at the east foot of the Saw Tooth Mountains.

Record of specimens collected of Fiber zibethicus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23868	31268	1766	Lemhi, Idaho	Sept. 3, 1890	♂	580	258	[illegible]
24559	31954	1873	Saw Tooth Lake, Idaho	Sept. 26, 1890	♀ ad.	580	260	[illegible]
24558	31953	1902	....do	Sept. 29, 1890	♂ im.	540	242	[illegible]
24431	31837	1912	....do	Sept. 30, 1890	♀ im.	506	240	[illegible]
....	31480	1927	....do	Oct. 2, 1890	♀ im.	......	......	......
....	31479	1928	....do	Oct. 2, 1890	♂ im.	......	......	......

Thomomys clusius Coues. Pale Pocket Gopher.

Thomomys clusius Coues, Proc. Acad. Nat. Sci. Phila., 1875, 138 (type from Bridger Pass, Wyoming).

The common Pocket Gopher of the Snake Plains and the valleys of Big Lost River and Birch Creek is here referred provisionally to this species. Specimens from the foothills east of Blackfoot show a tendency to run into the dark form inhabiting the mountains. It may be well to state in connection with the name here adopted that Bachman's types of *borealis* and *townsendi* (now in the museum of the Philadelphia Academy of Sciences) have been compared with the present species and found to be not the same.

Lewis and Clark noticed hills of the Pocket Gopher along the Clearwater in Idaho in May, 1806, and described them thus:

"In many parts of the plain the earth is thrown up into little mounds by some animal whose habits most resemble those of the Salamander [*Geomys tuza* Ord]; but although these tracks are scattered over all the plains from the Mississippi to the Pacific, we have never yet been able to obtain a sight of the animal itself" (Lewis and Clark's Travels, Paul Allen Ed., vol. II, 1814, p. 273).

Thousands of persons spend their entire lives in the midst of colonies of Pocket Gophers without ever seeing a specimen. At the same time the animals are easily caught when one has learned how, as may be inferred from the accompanying table, and it may be added that several times the number here enumerated could have been captured had we so desired.

Record of specimens collected of Thomomys clusius.

al o. ll.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
86	38	Big Butte, Idaho	July 19, 1890	♂	195	73	23
93	1457	....do	July 20, 1890	♂	187	54	23
23	1467	Big Lost River, Idaho	July 22, 1890	♂	168	54	22
...	1484	...do	July 23, 1890	♀	173	55	22
22	1485	...do	....do	♀	179	56	24
76	1531	Birch Creek, Idaho	Aug. 4, 1890	♂	162	52	22
73	1532	....do	....do	♂	161	48	21.5
74	1533	....do	....do	♀ im.	150	48	21.5
72	1536	....do	Aug. 5, 1890	♂	164	50	22
75	1562	....do	Aug. 7, 1890	♂ im.	187	60	24
71	1563	....do	....do	♂ im.	172	53	22
52	1574	...do	Aug. 9, 1890	♀	188	56	24
01	1575	...do	....do	♀	188	60	23.5
53	1577	....do	Aug. 10, 1890	♂	174	56	22
52	98	...do	Aug. 4, 1890	♂	171	53	23
51	99	....do	....do	♀	155	45	21
44	100	....do	Aug. 5, 1890	♀	159	45	21.5
99	101	....do	....do	♀	160	43	21
50	102	...do	....do	♂	160	45	22
53	106	....do	....do	♂	158	42	22
54	108	...do	....do	♀	172	57	23
98	109	....do	....do	♂	177	52	23
00	129	....do	Aug. 8, 1890	♂	179	47	23
96	137	....do	Aug. 9, 1890	♀	161	50	22
51	138	....do	....do	♂	164	50	22
50	139	....do	Aug. 10, 1890	♀	161	42	22.5
97	140	....do	....do	♀	165	48	23
95	141	....do	....do	♂	162	44	22
85	1441	Blackfoot, Idaho	July 15, 1890	♂	189	53	23
83	21	....do	July 14, 1890	♀	176	52	22
82	23	....do	....do	♀	177	53	24
88	24	....do	July 15, 1890	♀	175	50	23
91	25	....do	....do	♀	174	49	23.5
94	26	....do	....do	♀	171	49	23
02	27	....do	....do	♀	178	53	24
89	32	....do	....do	♂ ad.	194	54	25
90	34	....do	July 16, 1890	♀	183	50	25
....	35	...do	....do	♀	180	54	21
84	36	....do	....do	♂	170	52	24

s clusius fuscus subsp. nov. Mountain Pocket Gopher.

cket Gophers inhabiting the mountains of Idaho are very differ- those of the sage plains and valleys, being larger and wholly in color. *T. clusius* from the Snake Plains is whitish, washed buffy ochraceous, while the mountain animal is dull chestnut. cimens of the former the hind foot measures from 21 to 24^{mm}; the latter it varies from 25 to 31^{mm}. Where the ranges of the two forms meet there is a tendency to intergrade. This is particularly noticeable in specimens from the foothills east of Blackfoot.

At Saw Tooth Lake fresh hills were thrown up after snowfall in early October.

In 1872 I secured a specimen in Teton Cañon (No. $\frac{11106}{12420}$, ♀, U. S. Nat. Mus.).

THOMOMYS CLUSIUS FUSCUS subsp. nov.

Type No. $\frac{24267}{31671}$, ♀ ad., U. S. National Museum (Department of Agriculture collection). From mountains at head of Big Lost River, Idaho, September 23, 1890. Collected by Basil Hicks Dutcher (Original number, 1847).

Measurements (taken in flesh).—Total length, 215; tail vertebræ, 72; hind foot, 27. Ear from crown, 3 (in dry skin).

General characters.—Similar to *T. clusius*, but larger and very much darker in coloration, the upper parts being dull chestnut instead of buffy whitish. This Pocket Gopher needs no comparison with either *T. talpoides* from Dakota or *T. fulvus* from Arizona, the small size of its fore feet being sufficient to distinguish it at a glance from these species.

Color.—Upper parts uniform dull chestnut; circle around ear blackish; tail and feet soiled whitish; under parts plumbeous, strongly washed with fulvous.

Record of specimens collected of Thomomys clusius fuscus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23673	31067	1613	Salmon River Mountains, Idaho	Aug. 20, 1890	♂	200	70	[illegible]
24304	31708	1614	....do	....do	♀	162	37	25
23674	31068	1615	....do	Aug. 21, 1890	♂	200	70	25.5
23537	30955	1616	....do	....do	♀	197	68	[illegible]
23671	31065	1617	....do	....do	♀	194	67	25
23536	30954	1618	....do	....do	♀	192	63	[illegible]
23675	31069	1619	....do	....do	♀	178	60	24
23672	31066	1626	....do	Aug. 23, 1890	♀	188	63	25
23817	31217	1656	....do	Aug. 25, 1890	♀	208	70	26
23816	31216	1657	....do	....do	♀	178	42	[illegible]
23815	31215	1711	....do	....do	♀ im.	148	45	21.5
23818	31218	1762	Lemhi, Idaho	Sept. 3, 1890	♀	192	61	25
23819	31219	1763	....do	....do	♂	191	54	25
24267	31671	*1847	Mountains at Head of Big Lost River, Idaho.	Sept. 23, 1890	♀	215	72	27
24268	31672	1848	....do	....do	♀	205	71	29
24269	31673	1930	Saw Tooth Lake, Idaho	Oct. 3, 1890	♀ im.	192	70	[illegible]
23243	30700	85	Lost River Mountains, Idaho	July 31, 1890	♂	188	60	25
23244	30701	86	....do	....do	♀	191	66	[illegible]
23241	30698	87	..do	....do	♀	200	69	[illegible]
23242	30699	88	....do	....do	♀	186	63	[illegible]
23240	30697	89	....do	Aug. 1, 1890	♀	183	65	[illegible]
23150	30595	1448	Blackfoot, Idaho	July 16, 1890	♂	232	78	31
23142	30587	1452	...do	July 17, 1890	♂ im.	194	66	[illegible]

*Type.

dops ordii Woodhouse. Ord's Kangaroo Rat.

Kangaroo Rat provisionally referred to this species is common ughout the Sonoran zone of Idaho, inhabiting sandy places in the ce Plains and its northward prolongations between the mountains. as noticed in Birch Creek and Lemhi Valleys, and in Big Lost, Litost, Pahsimeroi, Round or Challis, and Antelope Valleys.

Record of specimens collected of Dipodops ordii.

National um No.	Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skull.							
30548	1416	Blackfoot, Idaho	July 10, 1890	♂	221	128	39
30544	1423	....do	July 11, 1890	♂	237	144	40
30547	1424	....do	....do	♀	242	136	42
30534	1425	....do	July 12, 1890	♂	223	132	39
30535	1426	....do	....do	♂	197	110	39
30549	1427	... do	... do	♂	188	105	38
30543	1431	...do	July 13, 1890	♂	192	108	39
30546	1432	....do	....do	♂	188	102	39
30545	1433	....do	....do	♀	233	137	40.5
30538	1443	....do	July 15, 1890	♀	236	139	40
30539	1444	...do	....do	♀	198	111	39
30537	1450	....do	July 16, 1890	♂ juv	184	104	36
30536	22	....do	July 14, 1890	♂	246	137	39
30533	28	....do	July 15, 1890	♂	242	140	39
30829	1561	Birch Creek, Idaho	Aug. 7, 1890	♀ ad	259	148	40
30830	1565	....do	....do	♀	252	143	42
31452	1840	Challis, Idaho	Sept. 20, 1890	♀ ad	255	139	40
31453	1842	... do	Sept. 21, 1890	♀	250	138	40.5

gnathus olivaceus Merriam. Pocket Mouse.

nathus olivaceus Merriam, N. Am. Fauna, No. 1, October, 1889, pp. 15–16 (type from Kelton, Utah).

ommon throughout the Sonoran zone in Idaho, living in small coloin burrows in the gravel benches. Specimens were captured in hi Valley near the Indian Agency and near Junction, and in Birch k Valley at Johnston's ranch 16 kilometers (10 miles) south of Nich- Several were trapped in the Pahsimeroi Valley, and others at kfoot and Big Butte on the Snake Plains.

ll of the Idaho specimens are a little smaller than true *P. olivaceus* northern Utah.

Record of specimens collected of Perognathus olivaceus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
22994	30440	17	Blackfoot, Idaho	July 13, 1890	♂	147	74	20
23097	30542	29	do	July 15, 1890	♂	167	63	23
23096	30541	37	Big Butte, Idaho	July 19, 1890	♀	169	64	22.5
23476	30894	1569	Birch Creek, Idaho	Aug. 9, 1890	♂	161	85	21.5
23547	30965	1598	do	Aug. 14, 1890	♂ im	150	80.5	22
23546	30964	1599	do	do	♀	151	86	22
23834	31234	1742	Lemhi Indian Agency, Idaho	Sept. 2, 1890	♀ ad	166	90	21
23837	31237	1780	Pahsimeroi Valley, Idaho	Sept. 13, 1890	♂	174	95	22
23836	31236	1822	do	Sept. 17, 1890	♂	174	95	23
23835	31235	1823	do	do	♀ im	160	85	21.5

Erethizon epixanthus Brandt. Yellow-haired Porcupine.

Common throughout the mountains of central Idaho. In Saw Tooth Mountains their gnawings were most frequently noticed on *Pinus murrayana*, and rather low down. In a cañon in the Lost River Mountains Mr. Basil Hicks Dutcher encountered a Porcupine sitting in a shady nook under a rocky cliff screened by undergrowth. The specimen was preserved. A dead Porcupine was found in the sage brush near the sink of Birch Creek. Tracks were seen in the cañon of Snake River near Shoshone Falls, and on the Brunneau Mountains between Idaho and Nevada.

August 10, 1872, I killed a female Porcupine at Henry Lake (skull No. 12405, U. S. Nat. Mus.).

Record of specimens collected of Erethizon epixanthus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23713	31107	1518	Lost River Mountains, Idaho	July 30, 1890	♀	740	187	89
	30625	1489	Big Lost River, Idaho	July 22, 1890				

Zapus hudsonius (Zimmermann). Jumping Mouse.

Common in moist places along the lower part of the Canadian or Douglas fir zone of the Salmon River Mountains, and probably throughout the coniferous forests of Idaho. Several were caught in traps set for shrews in a marsh bordering a beaver pond. This form differs from the common Jumping Mouse of the eastern United States in having the skull broader and shorter, and the brain case more highly inflated. The buffy ochraceous color of the sides is somewhat paler than in eastern specimens and very much paler than in those from the Pacific coast

Record of specimens collected of Zapus hudsonius.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23538	30956	1634	Salmon River Mountains, Idaho..	Aug. 23, 1890	♀.....	231	140	31
23539	30957	1663	....do	Aug. 25, 1890	♀.....	222	134	29
23540	30958	1675	....do	Aug. 26, 1890	♂.....	222	135	32
23790	31199	1718	....do	Aug. 29, 1890	♂ ad..	232	140	32
[illegible]	31200	1733	....do	Aug. 31, 1890	♂......	246	152	33

Lagomys princeps Richardson. Rocky Mountain Pika.

The Rocky Mountain Pika is common in the rock slides of the Boreal Province in Idaho. In the Salmon River, Pahsimeroi, and Saw Tooth Mountains we found it ranging from the Canadian zone to within a short distance of the summits of the highest peaks. It was encountered most abundantly in the neighborhood of timber line, between the altitudes of 3,050 and 3,350 meters (10,000 and 11,000 feet), perhaps because suitable rock slides are most frequent at this elevation. The lowest colony discovered in the Salmon River Mountains inhabited a mass of volcanic slide rock surrounded by Douglas fir and Murray pine on the east slope of the range at about 2,620 meters (8,600 feet). In a narrow part of the valley of Big Wood River, near its headwaters, a few individuals were found in slides as low as 2,255 meters (7,400 feet). It was observed also in the mountains between the headwaters of Big Lost River and Trail Creek.

Pikas are noisy little creatures and are not likely to let anyone pass near by without making their presence known. Their cry has been described as a 'bleat' resembling that of a young lamb, but the simile is strained. Their ordinary note is *eh-eh*, spasmodically ejaculated and several times repeated. Sometimes it is shriller and more like *ee-ee*, uttered many times in rapid succession.

They are active, nimble little bodies, springing lightly from rock to rock, and running swiftly to and from their feeding grounds, often several hundred feet away.

Their chief food-plant is a pretty little Arctic-alpine species (*Geum rossii*) which forms mats of green among the rocks and bears conspicuous yellow flowers. This is their 'hay,' and they lay up large quantities of it for winter use, depositing it in little heaps in the spaces between the rocks. These storehouses average about the size of a bushel measure and contain, in addition to the leaves and flowers of *Geum rossii*, a few heads of purple *Aster* and a golden *Senecio*.

The Pikas are very industrious. In early autumn they are constantly engaged in carrying hay to their storehouses except when interrupted by intruders, at whom they stare and scold before plunging out of sight among the rocks. Soon after silence is restored they reappear, and their cry may be heard from a hundred points. They crawl out upo the rocks and sit motionless for awhile, and if undisturbed soon retur to their task of laying up food for winter. I have watched them by th hour while thus engaged, running rapidly to the side of the slide, gat ering a mouthful of leaves, and returning as swiftly to deposit it in th usual place. For such short-legged animals their speed is surprisin as well as the long leaps they make from rock to rock, never losing the footing. Their movements are not attended by any noise, which ci cumstance is due in part to the lightness of their bodies and in part the dense pad of fur which covers the soles of their feet.

The Pika probably remains active throughout the winter, durin which period the great depth of snow covering its home keeps out th cold winds and prevents the temperature from falling very low. Th it does not hibernate is evident from two facts: (1) It lays up lar storehouses of food for winter use; (2) it does not become fat as wint approaches.

One afternoon, about the 1st of September, Mr. Vernon Bailey an I carried our blankets up to a *Lagomys* slide above timber-line on th Salmon River Mountains and spent the night there. As darkness fe upon the mountains a storm set in. The wind blew a furious gale an rain began falling. Soon the rain changed to hail and sleet, and finall to snow. Much to our surprise we heard the unmistakable cry of th Pikas at frequent intervals throughout the night. Whether they ar usually nocturnal as well as diurnal, or whether the storm set them a work to move their storehouses to safer places, we have no means knowing.

In 1872 I collected this species in Teton Cañon near the boundar between Idaho and Wyoming (No. $\frac{11114}{12430}$ U. S. Nat. Mus.).

Record of specimens collected of Lagomys princeps.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Hind foot.
Skin.	Skull.						
23488	30906	1585	Salmon River Mountains, Idaho	Aug. 11, 1890	♂	177	
23366	30826	121	do	Aug. 6, 1890	♂	176	
23487	30905	146	do	Aug. 11, 1890	♀ ad.	169	
23484	30902	147	do	do	♀ ad.	183	
23485	30903	148	do	do	♂ ad.	190	
23663	31057	1679	do	Aug. 26, 1890	♂	185	
23664	31058	1680	do	do	♀	180	
23665	31059	1681	do	do	♂	182	
23807	31207	1685	do	Aug. 27, 1890	♂	175	
23808	31208	1686	do	do	♂	180	
23806	31206	1687	do	do	♂	170	
23804	31204	1688	do	do	♂	180	
23812	31212	1689	do	do	♀ (?)	178	
[illegible]810	31210	1690	do	do	♂	180	

Record of specimens collected of Lagomys princeps—Continued.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Hind foot.
Skin.	Skull.						
23813	31213	1691	Salmon River Mountains, Idaho	Aug. 27, 1890	♂	180	31
23811	31211	1692	....do	....do	♀	182	30
23809	31209	1693	....do	....do	♂	180	30
23805	31205	1694	....do	....do	♂	190	31
23814	31214	1731	....do	Aug. 30, 1890	♀ ad	180	30
23543	30961	174	....do	Aug. 19, 1890	♀	180	28
23486	30904	175	....do	....do	♀	176	29
23544	30962	176	....do	....do	♀	159	29
23545	30963	177	....do	....do	♂ (?)	166	28.5
24039	31455	1854	Head of Wood River, Idaho	Sept. 25, 1890	♀	175	30
24381	31787	1941	....do	Oct. 5, 1890	♀ ad	170	29
24379	31785	1942	....do	....do	♂ ad	172	30
24380	31786	1943	....do	....do	♂ ad	170	30
....	30990	....	Salmon River Mountains, Idaho	Aug. 27, 1890	....	......	......

Lepus idahoensis sp. nov. Idaho Pygmy Rabbit.

When I first saw this little Rabbit in the field the idea occurred to me that it might be *Lepus nuttalli* of Bachman, described in 1837 from a specimen collected on the Snake Plains by Townsend, and believed at that time to be "the most diminutive of any species of true hare yet discovered." But on returning to the East and examining the type of *L. nuttalli*, which is still in the Museum of the Academy of Natural Sciences of Philadelphia, I find the latter to be a young Cotton-tail, with a "rather long, full tail," pure white beneath, as pointed out by Baird and Allen, and I wholly concur in the opinion that it is the young of the species afterward described by Bachman (in 1839) as *L. artemisia*. The type locality of *L. artemisia* is the Plains of the Columbia near Walla Walla, a direct continuation of the Snake Plains.

Geographic Distribution.—*Lepus idahoensis* inhabits the Sage Plains bordering Snake River, in Idaho, and the northward extensions of these plains in the Birch Creek and Lemhi Valleys, Little Lost River Valley, Pahsimeroi Valley, and Big Lost River Valley. To the south it ranges into northern Nevada, and to the west probably into eastern Oregon and Washington.

Habits.—That but half a dozen specimens of this little rabbit were secured during more than two months spent in the very center of its abundance seemed very strange to us until we learned, near the close of the trip, two important facts concerning its habits, namely, that it is almost exclusively nocturnal and that it makes its home in deserted holes of the Badger (*Taxidea americana*). The only individual I succeeded in shooting was killed at the mouth of a Badger hole just at daylight, and the specimens trapped were caught at the mouths of old

Badger holes which had been partly filled with earth. Had we learned these facts earlier we could easily have captured many more. Two or three others were caught but were eaten in the traps by Coyotes.

This Rabbit has very short legs, and in running keeps close to the ground, not leaping, as most rabbits do. It was never found away from the plains and valleys covered with sage (*Artemisia tridentata*) and *Tetradymia canescens.*

LEPUS IDAHOENSIS, sp. nov.

Type No. $\frac{24045}{31451}$ ♂ ad. From Pahsimeroi Valley, Idaho, September 16, 1890. Collected by Basil Hicks Dutcher (Original No. 1816).

Measurements (taken in flesh by C. H. M.)—Total length, 290; tail, 15; hind foot, 71. Ear (measured in dry skin) from notch, 42, from anterior base, 58.

General characters.—Size smallest of North American Rabbits, with the possible exception of *L. cinerascens* recently described from southern California by Dr. J. A. Allen. Ears short and broadly rounded. Hind legs and feet rather short. Tail rudimentary.

Color.—The material at hand (five specimens) indicates that there are two very distinct color phases in this Rabbit, a summer pelage (which is also that of the young) somewhat resembling *L. sylvaticus*, and a winter pelage of clear drab-gray, which is unique among Rabbits so far as I am aware.

Winter pelage.—The type specimen (No. 24045, Pahsimeroi Valley, Idaho, Sept. 16, 1890) and another taken at the same time and place (No. 24047) are in winter pelage except on the head and neck, which parts are changing or still in summer pelage. Another specimen (24046 ♀ ad.), taken near the head of the valley of Big Lost River a week later (September 22), has nearly completed the change, the old fur remaining on the cheeks and sides of the neck only. In these specimens, with the exceptions indicated, the color of the head, body, and thighs is a uniform pure drab-gray entirely free from any tinge of fulvous, and somewhat mixed with black-tipped hairs on the back. The nape spot is small, dull ochraceous buff in color, and wholly concealed when the ears are laid back. The fore and hind feet are pale, dull ochraceous buff. The drab-gray of the upper parts extends well down on the sides and encroaches on the under parts, leaving but a narrow strip of whitish along the median line of the belly. The pectoral band is grayish buff. The ears are pale buff inside; dull buffy-ochraceous outside, mixed with gray and black-tipped hairs anteriorly and bordered in front with a blackish line.

Summer and immature pelage.—Similar to the winter pelage but with the drab-gray of the upper parts replaced by gray more or less strongly suffused with buff and everywhere intimately mixed with black. The two pelages really differ much more than indicated by the description. The [illegible] fully adult specimen procured in complete summer pelage was [illegible]lly destroyed. It was killed near Big Butte, Idaho, about [illegible]890. An immature male (No. 23542) taken in Birch Creek

Valley, Idaho, August 12, 1890, is nearly full grown and is conspicuous for the abundance of black-tipped hairs on the back and sides. The sides of the belly are strongly suffused with pale buffy ochraceous. A still younger individual (No. 23541 ♀ juv.) collected in the upper Lemhi Valley (near Junction) Idaho, August 16, 1890, is very much paler above (the black-tipped hairs being inconspicuous) and the under parts are washed with buffy. The texture of the pelage is soft and woolly as usual in young rabbits.

Cranial characters.—The skull of *Lepus idahoensis*, aside from its small size, is remarkable for its breadth, shortness, and the flatness of the parietal region. The ratio of zygomatic breadth to basilar length of Hensel is 73.8 against 65 millimeters in an average specimen of *L. sylvaticus nuttalli* from the same locality, and the corresponding ratios of breadth of brain case to basilar length are 58.5 and 52. The depression of the brain case is best seen from behind, though it is very apparent from the side also. The foreshortening of the skull is brought about chiefly at the expense of the facial portion. The nasal bones are conspicuously short, the ratio of their length to basilar length being 48.4 against 60 in *L. sylvaticus nuttalli.*

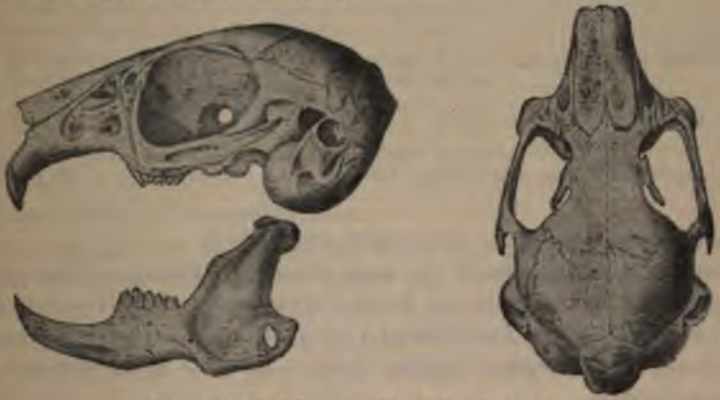

FIG. 4.—Skull of *Lepus idahoensis* type (nat. size).

The audital bullæ are enormously inflated, being actually as large as in *L.sylvaticus nuttalli* from the same region. The supraorbital processes are small, slender, and are not in contact with the side of the skull posteriorly; anteriorly they fail altogether or exist as little more than spicules. The sulcus on the outer face of the zygomatic arch is very shallow and is not fenestrated. The under surface of the basi-occiptal is deeply grooved longitudinally. The palatal bridge extends from the plane of the interspace between the first and second lateral teeth to the plane of the fourth, or the interspace between the fourth and fifth.

General remarks.—*Lepus idahoensis* requires comparison with no other Rabbit, its small size, short head, apparent absence of tail, and peculiar coloration serving to distinguish it at a glance from all previously known species.

Record of specimens collected of Lepus idahoensis.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
24045	31461	*1816	Pahsimeroi Valley, Idaho	Sept. 16, 1890	♂ ad.	290	15	71
24047	31463	1821	....do	Sept. 17, 1890	— ad.	300	18	78
24046	31462	1842	Big Lost River Valley, Idaho	Sept. 22, 1890	♀ ad.	270	16	72
23542	30968	1802	Birch Creek, Idaho	Aug. 12, 1890	♂ im.	250	12	61
23541	30969	1804	Junction, Idaho	Aug. 16, 1890	♀ im.	212	14	53

* Type.

Lepus campestris Bachman. White-tailed Jack Rabbit.

Tolerably common throughout the greater part of the sage plains, extending north throughout the valley of Birch Creek and Lemhi River to Salmon City, and through the Little Lost and Pahsimeroi Valleys to Salmon River and Round or Challis Valleys. Found also in the valley of Big Lost River.

Record of specimen collected of Lepus campestris.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23715	31109	169	Head of Lemhi River, Idaho	Aug. 16, 1890	♀	604	105	10

Lepus texianus Woodhouse. Black-tailed Jack Rabbit.

Common in most parts of the sage plains and valleys. This species was observed in the valley of Birch Creek and Lemhi River, in Little Lost River Valley, the Pahsimeroi Valley, Round or Challis Valley, Big Lost River and Thousand Spring Valley, and was more common than *Lepus campestris*.

In September, 1854, Dr. George Suckley found this species "exceedingly abundant on the left bank of the Boise River." He says: "They are so numerous that our command of 60 men subsisted on them for nearly a week. In a short ride of an hour's duration to see 30 near to the trail was nothing remarkable. The natives (Diggers) make garments by sewing many of their skins together. This hare breeds in great numbers on the vast sage plains to the south of Boise River, between it and Snake River." (Pacific R. R. Reports, Vol. XII, Book II, 1860, Chap. II, p. 105.) His subsequent remark that "they are said to turn white in winter" evidently refers to the following species (*L. campestris*), which is the only Jack Rabbit known to undergo this seasonal change of color. That his previous remarks refer to *L. texianus* is shown by the description, which states that the upper surface of the *tail and* central line of the rump are black.

Record of specimens collected of Lepus texianus.

S. National useum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.
in.	Skull.								
922	31327	1415	Blackfoot, Idaho............	July 9, 1890	♀ ad..	560	94	134	163
365	30625	1494	Arco, Idaho................	July 26, 1890	♂ im..	240	39	65	77

pus sylvaticus nuttallii Bachman. Sage Cotton-tail.

Common throughout the sage plains and particularly abundant in ckets of willows bordering streams.

Record of specimens collected of Lepus s. nuttallii.

S. National useum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.
in.	Skull.								
906	31310	1736	Lemhi Indian Agency, Idaho	Sept. 1, 1890	♂.....	385	52	95	85
802	31202	1737	....do........................	....do.......	♂.....	312	35	86	70
801	31201	1738	....do........................	....do.......	♀.....	345	47	90	71
	31167	1773	Lemhi Valley, Idaho.......	Sept. 5, 1890	♀ ad..	......	......	......	......
860	30506	20	Blackfoot, Idaho	July 13, 1890	♀.....	......	......	......	......
714	31108	57	Big Lost River, Idaho......	July 24, 1890	♀ ad..	370	50	94	......
249	30705	68	Lost River Mountains, Idaho	July 29, 1890	♀.....	295	35	78	......
...	31166	1755	Lemhi Indian Agency, Idaho	Sept. 2, 1890	♀.....	......	......	......	......

pus bairdii Hayden. Snow-shoe Rabbit.

Common in thickets in the Salmon River and Saw Tooth Mountains. e first specimen secured was shot by Mr. Bailey on the high divide ween Trail Creek and the headwaters of Big Lost River September Several others were secured at Saw Tooth or Alturas Lake in Octoer. The latter were beginning to change from summer to winter age.

Record of specimens collected of Lepus bairdii.

S. National useum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.
in.	Skull.								
30	31836	1846	Big Lost River Valley, Idaho	Sept. 22, 1890	♂	405	28	130	103
65	31475	1932	Saw Tooth Lake, Idaho	Oct. 3, 1890	♂	450	35	142	100
66	31476	1933	....do........................	....do.......	♀	445	37	145	98

e americanus Jardine. Moose.

Occurs in the Salmon River Mountains, but is not common anywhere. July 26, 1872, an old cow Moose and two large calves were killed in on Cañon, near the boundary between Idaho and Wyoming, by the

Hayden Survey, and I worked all night long to prepare their skulls so that they could be sent out to Fort Hall on pack mules the next day (Nos. 12399 and 12400, U. S. Nat. Mus.).

Cervus canadensis Erxleben. Wapiti; Elk.

Common in the Saw Tooth and Pahsimeroi Mountains, and not rare in the Salmon River Mountains; occurs also in the Brunneau and Elk Mountains in extreme southern Idaho, and is said to inhabit the Blackfoot Mountains.

In 1872 we found Elk in abundance in the region about Henry Lake.

Cariacus macrotis (Say). Black-tail Deer; Mule Deer.

Common throughout the mountains of Idaho, and in the Brunneau Mountains between Idaho and Nevada. In winter it is common in the cañon of Snake River, where a hunter killed 11 early in October (near Shoshone Falls).

Cariacus virginianus macrourus (Rafinesque). Western White-tailed Deer.

Not observed by our party. Said to be common in some of the willow bottoms of southern Idaho and in the forests of northern Idaho.

Rangifer caribou (Kerr). Woodland Caribou.

Capt. Charles E. Bendire informs me that Caribou are common in northern Idaho and that they occur as far south as the neighborhood of Elk City, in Idaho County. A hunter named N. C. Linsley states that he and his partner killed 25 Caribou on Pend d'Oreille River during the winter of 1888–'89 (Forest and Stream, October 10, 1889, p. 227).

Antilocapra americana Ord. Antelope.

Tolerably common on the Snake Plains and found also in considerable numbers at the head of Little Lost River (where 32 were seen in one herd and many in small bunches), and about the headwaters of the Pahsimeroi, in September. A drove of more than 40 individuals was seen at the head of Cañon Creek, which empties into Salmon Falls Creek, in northern Nevada, October 15.

In 1872 many herds of Antelope were met with along the route of the Hayden Survey in eastern Idaho, and hundreds were seen in Teton Basin. The following year (1873) an epidemic disease broke out among them and the species has never regained its former abundance. Specimens were collected by me in 1872 on Middle Fork of Snake River (August 5), and on Cañon Creek (October 4—Skulls Nos. 12401 and 12402, U. S. Nat. Mus.).

Record of specimen collected of Antilocapra americana.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
....	31278	1827	Pahsimeroi River, Idaho	Sept. 15, 1890	♀ im.	.....	......	.....

Mazama montana Rafinesque. Mountain Goat.

Common on the higher peaks of the Saw Tooth and Salmon River Mountains, and said to be common on the Seven Devils. Seven were killed in the Saw Tooth Mountains west of Saw Tooth or Alturas Lake during our stay in early October, and fourteen were seen one day by a hunter named F. C. Parks.

Ovis canadensis Shaw. Mountain Sheep.

Common in the Salmon River and and Pahsimeroi Mountains, and occurring, though in smaller numbers, in the Saw Tooth Mountains. Said to be common in northern Idaho.

Bison bison (Linnæus). Buffalo.

Bos bison Linnæus, Syst. Nat., x, 1758, p. 72.

Bos americanus Gmelin, Syst. Nat., XIII, 1788, p. 204.

Bison americanus Smith, Griffith's Cuvier, Vol. v, 1827, p. 374 (name first used in this form by Catesby, "Nat. Hist. Carolina, II, 1754, App., 20, XXVIII"); Allen, American Bisons, 1876, 36 (*et auctorum plurimorum*).

Skulls and skeletons of Buffalo were found in the valley of Birch Creek and Lemhi River, in Little Lost River Valley, and in the upper part of Pahsimeroi Valley, but the species is now extinct in Idaho, except when stragglers from the Yellowstone Park wander into the adjacent mountains near the boundary line between Idaho and Montana.

John K. Townsend, during his overland journey from St. Louis to Oregon in 1834, frequently met with small herds of buffalo in southeastern Idaho and along Snake River. Many were killed for food and several calves were captured alive, but proved too unruly for pets. Under date of July 21, when near the site of old Fort Hall, he states: "The buffalo appear even more numerous than when we came, and much less suspicious than common. The bulls frequently pass slowly along within a hundred yards of us, and toss their shaggy and frightful looking heads as though to warn us against attacking or approaching them." Two days later four or five Indian hunters connected with the expedition killed sixty buffalo for the meat, which was dried for the journey. A few were found along the northern border of the Snake Plains in south central Idaho (Townsend's Narrative, 1839, p. 96 +. For other interesting records see *ibid.*, pp. 82, 87, 90, 93, 95. 96–97, 115).

Felis concolor Linnæus. Panther; Mountain Lion.

Occurs locally throughout Idaho. One was shot in Lemhi Valley in 1889, while feeding on the carcass of a cow.

Lynx baileyi Merriam. Plateau Wild Cat or Lynx.

Common in places; particularly abundant in the lava cañon of Snake River, where a fine specimen was caught in a trap baited with a duck's head and wings. Lynx tracks were seen in the Salmon River and Saw Tooth Mountains, but whether of this species is not known.

Record of specimens collected of Lynx baileyi.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.
Skin.	Skull.								
24215	31628	1966	Shoshone Falls, Idaho	Oct. 10, 1890	♀	930	180	187	68
....	31555	1962	...do	....do	......	......	......	......	......
....	31554	1963	....do	....do	......	......	......	......	......
....	30729	1595	Birch Creek, Idaho	Aug. 12, 1890	......	......	......	......	......

Vulpes macrourus Baird. Great-tailed Fox.

Mr. Bailey saw a skin of a Red Fox at a ranch on the lower part of Birch Creek, where it was caught. It was in winter pelage and bright yellowish in color without trace of cross marks.

Tracks of foxes were seen in the lower part of Birch Creek Valley and in the Saw Tooth Mountains.

Canis nubilus Say. Timber Wolf.

Said to be common in northern Idaho. A trapper named N. C. Linsley states that he and his partner killed forty wolves near Pend d'Oreille River during the winter of 1888–'89 (Forest and Stream, October 10, 1889, p. 227).

Canis latrans Say. Coyote; Prairie Wolf.

Abundant throughout the sage plains; heard howling nearly every night, and frequently seen in the daytime, particularly in early morning, skulking among the sage brush or behind clumps of willows bordering streams.

Record of specimens collected of Canis latrans.

U.S. National Museum No.		Original No.	Locality	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
....	30726	1594	Birch Creek, Idaho	Aug. 12, 1890	......	......	......	......
....	31556	1964	Shoshone Falls, Idaho	Oct. 10, 1890	......	......	......	......
....	31557	1965	...do	....do	......	......	......	......

Lutra hudsonica (Lacépède). Otter.

Common along most of the streams and lakes of Idaho, and in the cañons of Snake River. A female and young were captured on Birch Creek. The female weighed about 8½ kilograms (19 pounds avoirdupois) and the young about 4½ kilograms (10 pounds avoirdupois). Both were fat. The stomach of the mother contained the head of a Mallard Duck (*Anas boschas*) and parts of small fish that swarm in the creek. The Otter excrement found along the bank consisted almost entirely of fish scales and bones.

Record of specimens collected of Lutra hudsonica.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.
Skin.	Skull.								
24068	31478	1596	Birch Creek, Idaho.........	Aug. 14, 1890	♀ ad..	1,150	463	137	21
24067	31477	167	...do......................	...do	♀ jun..	985	386	113	......

Lutreola vison (Schreber). Mink.

Common along most of the streams. Four were caught on Birch Creek.

Record of specimens collected of Lutreola vison.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.
Skin.	Skull.								
23710	31104	1540	Birch Creek, Idaho........	Aug. 5, 1890	♂	520	170	65	14
23709	31103	1551	....do	Aug. 8, 1890	♂	508	167	66	13
23707	31101	1535	....do	Aug. 5, 1890	♀	510	171	61	14
23708	31102	1547	....do	Aug. 7, 1890	♀	470	138	59	13

Putorius longicauda Bonaparte. Long-tailed Weasel.

Weasels, provisionally referred to this species, are common in the Saw Tooth, Pahsimeroi, and Salmon River Mountains and tracks were seen in the Brunneau Mountains. Three were shot in the daytime and several were caught in marten traps baited with birds, chipmunks, and red squirrels. I met one high up in the Salmon River Mountains, September 5. He was in pursuit of a Richardson's Squirrel in a damp, moss-covered place in a dark spruce forest and stood bolt upright when he saw me. I wounded him with my auxiliary and he immediately emitted his powerful stench and disappeared in a hole at the root of a spruce.

July 22, 1872, I collected a young Weasel in Teton Basin, Idaho (No. $\frac{11193}{12416}$ U. S. Nat. Mus.).

Record of specimens collected of Putorius longicauda.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
23485	30911	122	Lost River Mountains, Idaho	Aug. 6, 1890	♂ im.	318	114	39
23676	31079	168	....do	Aug. 16, 1890	♂	352	117	39
23559	30977	1606	Salmon River Mountains, Idaho	Aug. 19, 1890	♂	380	144	43
23677	31071	1629	....do	Aug. 21, 1890	♂	375	136	43
23790	31190	1720	....do	Aug. 30, 1890	♂ im.	354	128	41
23792	31192	1723	....do	....do	♂ ad.	387	135	43.5
23791	31191	1724	....do	....do	♀	362	132	39
23903	31307	1814	Pahsimeroi Mountains, Idaho	Sept. 16, 1890	♀	330	113	36
....	30629	....	Big Butte, Idaho	July 21, 1890	....	....	....	....

Mustela americana Turton. Marten.

Common in the Salmon River and Saw Tooth Mountains. I caught one near Timber Creek in a trap baited with birds. Prospectors in the Saw Tooth Mountains complain of the depredations of Marten in carrying off their meat.

Record of specimen collected of Mustela americana.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.
Skin.	Skull.								
23907	31311	1700	Salmon River Mountains, Idaho	Aug. 27, 1890	♂ im.	585	182	88	38

Mustela pennanti Erxleben. Fisher.

Rare. A very handsome adult male Fisher was caught near Saw Tooth or Alturas Lake by Basil Hicks Dutcher, October 1, in a Marten trap baited with Chipmunks (*Tamias quadrivittatus*). It weighed 4,592 grams (10 pounds 2 ounces avoirdupois).

Record of specimen collected of Mustela pennanti.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.
Skin.	Skull.								
24112	31531	1914	Saw Tooth Lake, Idaho	Sept. 30, 1890	♂ ad.	1,013	395	128	41

Spilogale saxatilis Merriam. Little Striped Skunk.

A Little Striped Skunk believed to be this species is common in the cañons of Snake River, In 1872 I secured a skin at Marsh Valley, in southern Idaho (No. 11136 U. S. Nat. Mus).

Mephitis sp. ——? Skunk.

Apparently not common in the region traversed. A dead Skunk was found in the Salmon River Mountains but no specimens were caught. One was killed by a dog near Saw Tooth Lake in September.

Taxidea americana (Boddaert). Badger.

Abundant throughout the Snake River Plains and sage-covered valleys, sometimes ranging up the mountains as high as timber line. Badgers were found in unusual numbers about Timber Creek on the headwaters of the Lemhi, and also near the head of the Pahsimeroi, and many were observed in the daytime. An old female shot in Birch Creek Valley, August 5, by Mr. Bailey, had in her stomach a number of bumble bees with their comb and young bees, and also a Pocket Gopher (*Thomomys*). Badgers dig out Spermophiles, Chipmunks, Pocket Gophers, and Mice.

Record of specimens collected of Taxidea americana.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.	Ear from crown.
Skin.	Skull.								
23712	31106	1522	Lost River Mountains, Idaho.	July 31, 1890	♀	730	139	110	35
23711	31105	1555	Birch Creek, Idaho	Aug. 5, 1890	♀ ad..	770	143	118	44
....	31279	1828	Pahsimeroi River, Idaho ...	Sept. 15, 1890	....	......	......	......	......

Gulo luscus (Linnæus). Wolverine.

The dead body of a Wolverine was found near Timber Creek in the Salmon River Mountains by Basil Hicks Dutcher. The species was tolerably common in the Saw Tooth Mountains, where a trapper caught five last winter. One was killed on Blackfoot Mountains a few years ago, on what has been since known as Wolverine Creek.

Record of specimen collected of Gulo luscus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
....	30912	1605	Salmon River Mountains, Idaho....	Aug. 19, 1890	......	......	......	......

Procyon lotor (Linnæus). Raccoon.

Raccoons are common in the cañons of Snake River, where they feed largely on crayfish (*Astacus gambelii*).

Ursus horribilis, Ord. Grizzly Bear.

The Grizzly Bear is common in the Salmon River and Saw Tooth Mountains, and is said to occur in the Blackfoot Mountains also. One was killed near our camp on Timber Creek in August.

In 1872 several were seen in Teton Basin and an old female was killed in Teton Cañon, July 24 (skull No. 12397, U. S. Nat. Mus.). Grizzly Bears are said to be common in northern Idaho.

John K. Townsend, in the narrative of his overland journey to Oregon in 1834, frequently speaks of Grizzly Bears and states that three were killed and several others seen in one day (July 10, 1834) near Blackfoot River. One of those killed had claws "seven inches in length," and "the spread of the foot, laterally, was ten inches." They were abundant and bold along Snake River, and several were killed.

Lewis and Clark make frequent mention of Bears in the account of their memorable expedition across the continent. During the return journey they crossed Idaho along the course of the Kooskooskie (or Clearwater) in May and June, 1806. Under date of May 31, when encamped on the lower Clearwater, they made the following important entry concerning the Bears of the region:

"Two men visited the Indian village, where they purchased a dressed bear skin of a uniform pale reddish-brown color, which the Indians called yackah in contradistinction to hohhost, or the white bear. This remark induced us to inquire more particularly into their opinions as to the several species of bears; and we therefore produced all the skins of that animal which we had killed at this place, and also one very nearly white, which we had purchased. The natives immediately classed the white, the deep and the pale grizly red, the grizly dark brown, in short, all those with the extremities of the hair of a white or frosty color, without regard to the color of the ground of the foil, under the name of hohhost. They assured us that they were all of the same species with the white bear; that they associated together, had longer nails than the others, and never climbed trees. On the other hand, the black skins, those which were black with a number of entire white hairs intermixed, or with a white breast, the uniform bay, the brown, and light reddish brown, were ranged under the class yackkah, and were said to resemble each other in being smaller, and having shorter nails than the white bear, in climbing trees, and being so little vicious that they could be pursued with safety. This distinction of the Indians seems to be well founded, and we are inclined to believe—

"First. That the white or grizly bear of this neighborhood form a distinct species, which moreover is the same with those of the same color on the upper part of the Missouri, where the other species are not *found*.

"Second. That the black and reddish brown, etc., is a second species, equally distinct from the white bear of this country as from the black bear of the Atlantic and Pacific oceans, which two last seem to form only one species. The common black bear are indeed unknown in this country, for the bear of which we are speaking, though in most respects similar, differs from it in having much finer, thicker, and longer hair, with a greater proportion of fur mixed with it, and also in having a variety of colours, while the common black bear has no intermixture or change of colour, but is of a uniform black." (Lewis and Clark Expd., Paul Allen Ed., II, 1814, 303–304.)

Record of specimen collected of Ursus horribilis.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
....	31276	1677	Salmon River Mountains, Idaho.....	Aug. 24, 1890	♂...	1570	100	......

Ursus americanus Pallas. Black Bear.

Common throughout most parts of Idaho. A large 'Cinnamon' Bear was killed near Timber Creek, Salmon River Mountains, while feeding on the carcass of a steer. Black Bears are common in the Salmon River and Saw Tooth Mountains, where we saw many fresh tracks. In 1872 a male was killed at Henry Lake by the Hayden Survey (skull No. 12398, U. S. Nat. Mus.).

Lewis and Clark's remarks on the Black Bear are quoted under the preceding species.

Record of specimens collected of Ursus americanus.

U. S. National Museum No.		Original No.	Locality.	Date.	Sex.	Total length.	Tail vertebræ.	Hind foot.
Skin.	Skull.							
....	30728	1593	Lost River Mountains, Idaho	Aug. 1, 1890	......	......	......	......
....	31277	1678	Salmon River Mountains, Idaho	Aug. 24, 1890	......	......	......	......

ANNOTATED LIST OF BIRDS OBSERVED IN IDAHO DURING THE SUMMER AND FALL OF 1890, WITH NOTES ON SPECIES PREVIOUSLY RECORDED FROM THE STATE.

[The nomenclature adopted is that of the American Ornithologists' Union.]

Colymbus auritus. Horned Grebe.

Abundant on Saw Tooth Lake during the latter part of September and early October, moving about the lake in pairs, small companies, and large flocks. At least 100 were seen October 1. They were unusually free from suspicion, coming so near shore as to be easily killed, and 60 were counted from camp at one time.

Urinator imber. Loon.

One seen on Saw Tooth Lake, October 2. It seemed inquisitive about our camp fire and several times came within easy gunshot range.

Larus (californicus?). Gull.

I saw a Gull, believed to be this species, on Salmon River, near Challis, September 20.

Sterna forsteri. Forster's Tern.

Not observed by our party. In 1872 I secured a pair of Forster's Terns on Marsh Creek, in southern Idaho, June 30.

Phalacracorax dilophus cincinatus. White-crested Cormorant.

Several Cormorants, probably this form, were seen at Lewis Ferry, on Snake River, October 11.

Pelecanus erythrorhynchos. White Pelican.

Not seen by our party. Found at Henry Lake in 1872 by the Hayden Survey, and on Bear River in 1834 by Townsend (Townsend's Narrative, 1839, p. 82). The name 'Pelican Lake,' near the southeastern corner of the map of Idaho, implies the presence of this species at that point.

Merganser serrator. Red-breasted Merganser.

Several small flocks seen on Saw Tooth Lake.

Anas boschas. Mallard.

Breeds commonly on Birch Creek, where young unable to fly were killed the first week in August. Tolerably common on most of the streams visited during the latter part of August and throughout September. Several were shot on Birch Creek and Lemhi River in early

September, and six on Saw Tooth or Alturas Lake October 4. There were large flocks of ducks on the lake at the time, but we could not be sure of the species.

In 1872 I obtained young Mallards on Henry Fork of Snake River the middle of July. Townsend recorded the Black Duck (*Anas obscura*) from southeastern Idaho in 1834, but undoubtedly mistook the female Mallard for that species.

Anas strepera. Gadwall.

Not found by our party. In 1872 I found the Gadwall at Marsh Creek and Market Lake, and procured its eggs at the former locality in June.

Anas americana. Baldpate.

One shot and several others seen on Lemhi River August 31, and two shot on Saw Tooth or Alturas Lake October 2. Three were killed on some warm springs in the cañon of Snake River, near Shoshone Falls, October 9.

Anas carolinensis. Green-winged Teal.

Abundant in small flocks along most of the streams in the valleys of Birch Creek and Lemhi, Big and Little Lost Rivers, the Pahsimeroi, Big Wood, and Salmon Rivers. The Green-winged Teal breeds in the small streams in the mountains and moves down into the valleys during the latter part of the summer. Fifteen were shot in a few minutes on Bullberg Creek, at the head of Pahsimeroi Valley, September 12. When wounded they dive among the roots of the willows bordering the streams and are hard to find. Three were killed in the cañon of Snake River, October 10, in a small flock of Blue-winged Teal.

Anas discors. Blue-winged Teal.

One was killed near the sink of Little Lost River, July 27. Two were shot and others seen on Saw Tooth Lake about October 1, and several were shot on the warm springs in the lava cañon of Snake River, near Shoshone Falls, October 9–11.

Anas cyanoptera. Cinnamon Teal.

Not obtained by our party. June 29, 1872, I collected a nest containing nine eggs of this species at Marsh Creek, in southeastern Idaho.

Spatula clypeata. Shoveller.

Not observed by us, but recorded by Townsend from Bear River, in southeastern Idaho, more than half a century ago (Townsend's Narrative, 1838, p. 82).

Aythya americana. Redhead.

One shot on Saw Tooth Lake, September 27.

Branta canadensis. Canada Goose.

Not observed by our party. In July 1834, J. K. Townsend found this species near Snake River, in eastern Idaho (Townsend's Narrative, 1839, 99). Geese are common in northern Idaho.

Olor buccinator. Trumpeter Swan.

Capt. Charles E. Bendire informs me that he found the Trumpeter Swan breeding on Henry Lake, Idaho, in 1877. In August of that year, during the Nez Percé campaign, he observed several broods of young on the lake and shot two.

In 1872, when on the Hayden Survey, I procured two Trumpeter Swans near Jackson Lake, on Snake River, in Western Wyoming, September 23 (Nos. 62367 and 62368, U. S. National Museum).

Ardea herodias. Great Blue Heron.

Common on Snake River in July and August. Several were seen on Birch Creek in August, one on Salmon River, near Challis, September 20, and another on Snake River in October.

Grus mexicana. Sandhill Crane.

Several Sandhill Cranes were heard on a large meadow near the lower end of Saw Tooth Lake, September 26.

In 1872 the species was common along Henry Fork of Snake River early in August. Lewis and Clark found it along the Clearwater in May, 1806. Capt. Charles E. Bendire informs me that the Sandhill Crane breeds on Craig's Mountains, near Fort Lapwai, Idaho, where he found young in June, 1871; and that he found eggs on an island in Snake River, near Old's Ferry, in May, 1877.

Townsend stated in the narrative of his overland journey to Oregon in 1834 that he found the Whooping Crane on Bear River in southeastern Idaho, but I do not feel justified in inserting the species without additional authority.

Porzana carolina. Sora.

One seen and others heard in a marsh on Big Lost River, about 8 miles above Arco, July 26.

Fulica americana. Coot.

Two shot on Saw Tooth Lake, October 2.

Phalaropus lobatus. Northern Phalarope.

One shot and another seen by Mr. Basil Hicks Dutcher on a small alpine lake at timber line in the Salmon River Mountains, September 5.

Phalaropus tricolor. Wilson's Phalarope.

Not observed by our party. In 1872 I shot a Wilson's Phalarope in Marsh Valley, southeastern Idaho, June 30.

Recurvirostra americana. Avocet.

Mr. Dutcher saw a bird on Saw Tooth Lake the latter part of September which he believed to be an Avocet.

In 1872 I found the species on Henry Fork of Snake River in July.

Himantopus mexicanus. Black-necked Stilt.

Capt. Chas. E. Bendire tells me he found this species on Snake River, near Old's Ferry, in July, 1877.

Gallinago delicata. Wilson's Snipe.

One shot and others seen on Salmon River, near Challis, September 20.

Ereunetes occidentalis. Western Sandpiper.

A flock of fifteen seen and several killed on Big Lost River, near Arco, July 25.

Totanus solitarius. Solitary Sandpiper.

A few were seen on Lemhi River and Birch Creek, and one on the muddy bank of a beaver pond in the Salmon River Mountains.

Symphemia semipalmata inornata. Western Willet.

In 1872 I shot a Willet on Henry Fork of Snake River, July 16. It breeds abundantly at Great Salt Lake.

Actitis macularia. Spotted Sandpiper.

Tolerably common on Birch Creek and Lemhi River. Captain Bendire found it breeding near Fort Lapwai, Idaho (Proc. Bost. Soc. Nat. Hist. XIX, 1877, 141).

Numenius longirostris. Long-billed Curlew.

About the middle of July Mr. Bailey saw three adults and a half-fledged young near the point where the Blackfoot River emerges from the mountains. He says that the young was half covered with feathers and half down, that it looked like a small ostrich, and ran very fast.

In 1872 I found the Long-billed Curlew common in places on the Sage Plains from southern Idaho to Henry Fork of Snake River. Captain Bendire records it as breeding near Fort Lapwai "on the high and dry prairies several miles from the nearest water." (Proc. Bost. Soc. Nat. Hist., XIX, 1877, p. 141.)

Ægialitis vocifera. Killdeer.

Common along Snake and Blackfoot Rivers and in Lemhi and Birch Creek valleys, and also in the valley of Big Wood or Malade River. Several were seen about the warm springs in the lava cañon of Snake River, near Shoshone Falls, October 9–11.

Colinus virginianus. Bob-white.

The Eastern Quail or Bob-white has been introduced successfully near Boisé City, Idaho. In the Auk for July, 1885 (p. 315), Dr. Timothy E. Wilcox, Assistant Surgeon, U. S. Army, published the following:

"The Bob White (*Ortyx virginianus*) has been successfully introduced to the Boisé Valley, Idaho. Three years since, I found a covey on the west side of the Snake River, fifty miles below Boisé City, where they were first liberated. I never saw coveys so large or numerous as I found them about Boisé. Cover and food, as well as climate, are all favorable."

In the American Field of February 16, 1889, p. 148, Mr. Newton Hibbs, of Boisé City, states:

"Twelve years ago the business men of Boisé valley secured a coop of the little beauties from the East and gave them the liberty of the brushy borders of the wheat fields and the willows along the creeks and rivers. They have increased till now they are found in every suitable ground for fifty miles around. The meadows and grainfields are bordered by the finest kind of cover. There is no heavy timber in this valley; only cottonwoods and balms on the water courses, with a very jungle of briarberry bushes on every hand."

Dendragapus obscurus richardsonii. Richardson's Grouse; Blue Grouse.

Abundant in the coniferous forests of the Saw Tooth, Pahsimeroi, and Salmon River Mountains. It was usually found in small flocks, in which young birds predominated. This Grouse feeds extensively on a yellowish-red currant or gooseberry, and was sometimes found on open hill-tops engaged in catching grasshoppers. The crops of those killed contained grasshoppers and a few other insects, berries of *Arctostaphylos uva-ursi* and *Ribes cereum*, besides green leaves of the willow and other bushes.

In 1872 I found this Grouse common along the upper part of Henry Fork of Snake River in early August.

Capt. Charles E. Bendire informs me that the Pacific coast form of this Grouse (*Dendragapus o. fuliginosus*) occurs in the Boisé Mountains and in the foothills of the Wiser Valley Mountains, and that specimens from the mountains near Fort Lapwai may be referred to the same form.

Dendragapus franklini. Franklin's Grouse.

Said to occur in the Saw Tooth Mountains, where it is known as the 'Fool Hen,' and to be common in northern Idaho.

Bonasa umbellus togata. Canadian Ruffed Grouse.

Several Ruffed Grouse were killed in the Salmon River Mountains, near Eight-Mile Cañon, September 4. The species was not seen elsewhere.

Pediocætes phasianellus columbianus. Columbian Sharp-tailed Grouse.

The only Sharp-tailed Grouse seen during the entire season was killed in a flock of Sage Hens near the Lemhi Indian Agency, August 31.

In 1872 I found it near Fort Hall and on Portneuf and Snake Rivers. Captain Bendire states: "In the winter I have seen flocks of from one to two hundred in the vicinity of Fort Lapwai, Idaho." (Proc. Bost. Soc. Nat. Hist., XIX, 1877, p. 139.)

Centrocercus urophasianus. Sage Grouse.

Abundant throughout the sage plains and valleys, usually occurring in flocks of a dozen or more. This species furnished us with fresh meat during the greater part of the trip. While the flesh of the adults was usually more or less flavored with sage, the young, as a rule, were free from this taste.

In 1872 I found Sage Hens common in Teton Basin, along Henry Fork of Snake River, and at Henry Lake.

Zenaidura macroura. Mourning Dove.

Common everywhere until October; afterward rarely seen. Three nests containing two eggs each were found on the ground near Blackfoot about the middle of July.

Cathartes aura. Turkey Vulture.

Common along Snake River in July; three seen on Big Lost River, near Arco, July 25; common about the sink of Birch Creek during the early part of August; a few seen at the Lemhi Indian Agency, several in the Pahsimeroi and Challis Valleys, and others along Snake River, and thence south into Nevada.

Mr. Ridgway records this species from 'City of Rocks,' southern Idaho, October 3, 1868 (Bull. Essex Inst., vol. VII, 1875, p. 24).

Circus hudsonius. Marsh Hawk.

Common along the Lemhi and Birch Creek Valleys, and in the valleys of Little Lost, Pahsimeroi, Salmon, and Snake Rivers. An immature male shot in Lemhi Valley September 6 was more than half blue. Its stomach contained a Chipmunk (*Tamias minimus pictus*). Other stomachs examined contained remains of *Spermophilus townsendi* and *Neosorex*. One was seen at Saw Tooth Lake about October 1.

Capt. Charles E. Bendire found the eggs of this species near Fort Lapwai, June 15, 1871 (Proc. Bost. Soc. Nat. Hist., vol. XIX, 1877, p. 134).

Accipiter velox. Sharp-shinned Hawk.

Tolerably common in the wooded regions. A young male shot in the Salmon River Mountains, August 28, contained a Black-capped Warbler (*Sylvania pusilla pileolata*). One was seen as late as October 10 at Shoshone Falls on Snake River.

Accipiter cooperi. Cooper's Hawk.

A few seen in the mountains and in the valley of Birch Creek and the Lemhi. Captain Bendire states that he has found it breeding about Fort Lapwai, Idaho (Proc. Bost. Soc. Nat. Hist., XIX, 1877, 135).

Accipiter atricapillus. Goshawk.

Common in the Salmon River and Saw Tooth Mountains, where several were killed. One was caught at Saw Tooth Lake in a marten trap baited with a Richardson's Squirrel, and one was shot in Birch Creek Valley in the act of chasing chickens.

Buteo borealis calurus. Western Red-tail.

Common along Big Lost River below Arco the latter part of July. A number of empty nests were seen in the cottonwoods bordering the river, and young of the year were flying about. The stomach of one contained a *Spermophilus townsendi*. Rather rare elsewhere.

Buteo swainsoni. Swainson's Hawk.

Rather rare; one was killed 15 miles below Arco, July 22; a pair of old birds and a young just out of the nest were found on Birch Creek during the early part of August; an adult was observed catching grasshoppers on a bluff near Fort Lemhi in September, and still another near the head of the Pahsimeroi.

In 1872 I found a nest of Swainson's Hawk near Fort Hall, July 9. It was in a scrub cedar, and contained one young bird and one egg.

Aquila chrysaëtos. Golden Eagle.

Two or three Golden Eagles were observed at different times in the Salmon River Mountains and in Lemhi and Birch Creek Valleys.

Haliaëtus leucocephalus. Bald Eagle.

An adult White-headed Eagle was seen at Saw Tooth Lake, October 1, and another at Shoshone Falls on Snake River, October 10.

Falco mexicanus. Prairie Falcon.

Mr. Bailey found this species breeding in cliffs in the Blackfoot Mountains the early part of July, and shot one in the act of chasing a chicken in the lower part of Birch Creek August 7; its stomach contained a Horned Lark (*Otocoris*). A hawk supposed to be this species was seen in the upper part of the Pahsimeroi Valley, September 12. Several were seen on the lower part of Big Lost River about July 22.

In Birch Creek Valley they breed on lava cliffs, and were often seen chasing Teal up and down the creek.

Falco sparverius. Sparrow Hawk.

Common everywhere, feeding chiefly on grasshoppers. During the last week in July these hawks were observed feeding their young in the Lost River Mountains.

Pandion haliaëtus carolinensis. Fish Hawk; Osprey.

Twoor three Fish Hawks were seen flying south along the valley of Birch Creek the latter part of August; several were noticed on Salmon River between Challis and the mouth of the Pahsimeroi September 18–20; and the species was observed several times at Saw Tooth Lake the last week in September. There is a Fish Hawk's nest at Shoshone Falls on Snake River. It occupies the summit of a pinnacle of black basalt that rises from the water close to the top of the fall, on the south side. We were told that the nest was used the past season.

In 1872 I found a nest of this species on Henry Fork of Snake River, and Capt. Charles E. Bendire found a nest near Fort Lapwai in 1870 (Proc. Bost. Soc. Nat. Hist., XIX, 1877,134).

Asio wilsonianus. Long-eared Owl.

Mr. Clark P. Streator killed a female Long-eared Owl as she flew from a cave in the lava beds west of Blackfoot, July 17.

In 1872 I shot a female on Devil Creek, June 28. Capt. Charles E. Bendire says that this owl at Fort Lapwai, Idaho, occupies old nests of Crows, and also breeds in hollow cottonwood trees (Proc. Bost. Soc. Nat. Hist., vol. XIX, 1877, p. 131).

Asio accipitrinus. Short-eared Owl.

Not observed by us. Capt. Charles E. Bendire says of the Short-eared Owl: "This species breeds about Fort Lapwai, Idaho, where I took two of their nests on May 1 and 6, 1871. Both were found in swampy places, and constructed of dry grasses and a few feathers" (Proc. Bost. Soc. Nat. Hist., vol. XIX, 1877, p. 131).

Megascops flammeolus idahoensis subsp. nov. Dwarf Screech Owl.

The only specimen procured of this new owl was shot on a mountain on the west side of Big Wood River, only a few miles north of Ketchum, September 22. It may be distinguished from the Flammulated Owl by the following description:

MEGASCOPS FLAMMEOLUS IDAHOENSIS subsp. nov.

(Plate I, colored.)

Type No. 119654 ♂ ad. U. S. National Museum (Department of Agriculture collection). From Ketchum, Idaho, September 22, 1890. Collected by C. Hart Merriam and Vernon Bailey.

Similar to *M. flammeolus*, but smaller and paler. Wing, 125^{mm}; tail, 62^{mm} (measured from insertion of middle feathers). The back is only slightly paler than in *flammeolus;* the under parts are very much paler, the ground color being white and the vermiculations distant; the black markings are everywhere restricted. The facial ring is bright tawny ochraceous, and spreads out above so as to completely encircle the eyes; the cheeks are ash-gray and the chin white. The dusky spots in the facial ring are inconspicuous; in true *flammeolus* they are strongly developed, sometimes forming a black ring which is merely tinged with tawny. The black spots on the sides are very much reduced in size, and seem to be arranged in a single row.

Bubo virginianus subarcticus. Western Horned Owl.

Capt. Charles E. Bendire tells me that he shot this subspecies in 1871 at Fort Lapwai, Idaho, where it breeds, and also at Fort Sherman, Cœur d'Alene Lake, in 1880.

Bubo virginianus saturatus. Dusky Horned Owl.

Common in the Salmon River and Saw Tooth Mountains. One was caught in a steel trap baited with ducks' heads and wings at Saw Tooth Lake, September 30. It could not have been very hungry when it got into the trap for its stomach contained two Pocket Gophers (*Thomomys*), one White-footed Mouse (*Hesperomys*), one Field Mouse or Vole (*Arvicola*), and a new species of *Phenacomys*.

Nyctea nyctea. Snowy Owl.

A mounted specimen of the Snowy Owl was seen at the post-office at Birch Creek, and another in a ranch near by. We were informed that they were killed there in winter.

The Hawk Owl (*Surnia ulula caparoch*) unquestionably breeds in thern Idaho. August 11, 1872, I shot one on Madison River, Mon- only a few miles from the Idaho boundary.

Speotyto cunicularia hypogæa. Burrowing Owl.

Rare. A few were seen near Blackfoot in July, sitting at the mouths of old badger holes; and one was killed at Big Butte, July 18. Its stomach contained insects and several small scorpions.

In 1872 I collected specimens of this owl in Malade Valley and Portneuf Cañon, and at Fort Hall. Capt. Charles E. Bendire states that they are abundant at Fort Lapwai, Idaho, where he obtained a number of their eggs. (Proc. Bost. Soc. Nat. Hist., vol. XIX, 1877, p. 132.)

Ceryle alcyon. Belted Kingfisher.

Common along Snake River and most of the streams visited, and also about some of the beaver ponds and the lakes at the east foot of the Saw Tooth Mountains.

Dryobates villosus hyloscopus. Cabanis's Woodpecker.

Tolerably common in the spruce and fir forests of the Salmon River and Saw Tooth Mountains, and in the upper part of Wood River Valley; a few were seen among the trees along Birch Creek.

Dryobates pubescens. Downy Woodpecker.

One seen in some burnt timber in the upper part of Wood River Valley.

Xenopicus albolarvatus. White-headed Woodpecker.

I am informed by the Rev. Leroy T. Weeks that this handsome woodpecker is a common breeder at Grangeville, near Mount Idaho, not far from the western border of Idaho. Captain Bendire has recorded the species as breeding in the pine forests of the Blue Mountains in eastern Oregon, a locality not far distant from Grangeville, Idaho.

Picoides arcticus. Arctic Three-toed Woodpecker.

A male was shot at Saw Tooth Lake, October 3, by Basil Hicks Dutcher.

Picoides americanus dorsalis. Alpine Three-toed Woodpecker.

One was shot and several others seen in the Salmon River Mountains.

Ceophlœus pileatus. Pileated Woodpecker.

Rare. A fine male Pileated Woodpecker was shot by Mr. Bailey in the Salmon River Mountains, near Birch Creek, August 19. No others were seen. Rev. Leroy T. Weeks writes me that the species occurs near Mount Idaho, but is rare.

Melanerpes torquatus. Lewis's Woodpecker.

Not observed during the present season. In 1872 I found it common on Henry Fork of Snake River about the middle of July and secured three specimens. J. K. Townsend found this species along Bear River in extreme southeastern Idaho in July, 1834 (Townsend's Narrative, 1839, p. 82). Capt. Charles E. Bendire tells me that it breeds commonly about Fort Lapwai, Idaho.

Colaptes cafer. Red-shafted Flicker.

A few were seen along Snake River, near Blackfoot, in July, and at Big Butte, several along the lower part of Big Lost River, and many in the Lost River Mountains. A few were seen afterward in the Salmon River and Saw Tooth Mountains, the latter as late as the first week in October. Several were seen in the lava cañon of Snake River, near Shoshone Falls, October 9–11.

Phalænoptilus nuttalli. Poor-will.

One was killed on the lava beds west of Blackfoot, July 17, by Mr. Basil Hicks Dutcher; and the species was heard in a cañon in the Lost River Mountains the last week in July. A single individual was seen in Birch Creek Valley early in August.

The first eggs of this species ever discovered were collected by me in the western foothills of the Wahsatch Mountains, June 12, 1872.

Chordeiles virginianus henryi. Western Nighthawk.

Tolerably common on the sage plains and valleys. Mr. Dutcher found a set of eggs near Blackfoot, July 14, and a downy young was taken at Arco, July 25.

Trochilus platycercus. Broad-tailed Hummingbird.

A female was killed at Big Butte, July 19.

Trochilus sp.

A large Hummer, showing much rufous in flying, was seen several times along the lower part of Big Lost River and in Lemhi and Birch Creek Valleys.

Tyrannus tyrannus. Kingbird.

Common in July along Snake River, near Blackfoot, along Cedar Creek in the Blackfoot Mountains, and along the lower part of Big Lost River. Common along Birch Creek about the middle of August (several seen August 21).

In 1872 Kingbirds were common at Fort Hall and along Snake River and Henry Fork. I found a nest containing nearly fledged young on Blackfoot River, July 12, and one containing three fresh eggs on Snake River two days later.

Tyrannus verticalis. Arkansas Kingbird.

One seen at Big Butte and several along Big Lost River in July.

In 1872 I found it common along Devil Creek, in southeastern Idaho, and secured two nests containing eggs June 28.

Capt. Charles E. Bendire says of this flycatcher:

"At Fort Lapwai, Idaho, this species was very familiar and tame, several pairs breeding about the buildings of the post. One pair placed its nest on the sill of one of the attic windows of my quarters" (Proc. Bost. Soc. Nat. Hist., vol. XIX, 1877, p. 127).

Sayornis saya. Say's Phœbe.

Common in the lower Lemhi Valley. Capt. Charles E. Bendire says of Say's Pewee:

"At Fort Lapwai, Idaho, I found several of their nests about the buildings in the post, in fissures of rocks, and in old Cliff Swallows' nests. I have taken their eggs as early as April 17, 1871, containing then small embryos" (Proc. Bost. Soc. Nat. Hist., XIX, 1877, p. 127).

Contopus borealis. Olive-sided Flycatcher.

Not observed by our party. In 1872 I shot two Olive-sided Flycatchers in Teton Cañon, near the boundary between Idaho and Wyoming, July 27.

Contopus richardsoni. Western Wood Pewee.

Found in the Salmon River Mountains during the early part of August. Not seen after the middle of the month. This species was collected by me in Teton Cañon, in eastern Idaho, July 27, 1872.

Empidonax pusillus. Little Flycatcher.

One was killed along the lower part of Big Lost River in July, and two on Birch Creek in August (August 4, ♂; August 15, ♀). In 1872 I shot one of these flycatchers on Devil Creek, June 28.

Empidonax wrightii. Wright's Flycatcher.

One was killed on Birch Creek, August 4.

Otocoris alpestris arenicola. Desert Horned Lark.

Abundant throughout the sage plains and valleys. Adult males killed in July and August closely resemble the eastern subspecies, *praticola*, but the immature and spotted young are widely different, being very pale, while those of *praticola* are very dark.

Pica pica hudsonica. Magpie.

One of the most abundant and conspicuous birds of Idaho, occurring throughout the sage plains and valleys and extending up into the lower part of the Douglas fir zone. A dozen or more were often seen together and it was not unusual to count 20 or even 25 in sight at one time. Magpies were common at Saw Tooth Lake after snowfall in October, and undoubtedly winter in the neighborhood. Four were caught in our marten traps. They feed on carrion when other food is scarce, if not by preference. Half a dozen were seen perched on the body of a dead salmon in shallow water in Salmon River, near the mouth of the Pahsimeroi, September 18. They were hard at work tearing off and devouring the flesh. Several were seen in the cañon of Snake River at Shoshone Falls, October 9-11, and thence south to the East Humboldt River, Nevada, every day until October 17, when the expedition disbanded.

In 1872 I found Magpies common in Portneuf Cañon, at Pocotello, at Fort Hall, and on Snake River.

Cyanocitta stelleri annectens. Long-crested Jay.

Very rare. One was seen in the Salmon River Mountains, one near the Lemhi Indian Agency, one in the upper part of Wood River Valley, and three were seen and two secured near Saw Tooth Lake.

In 1872 I found this jay common in the Teton Basin, near the boundary line between Idaho and Wyoming.

Aphelocoma woodhousei. Woodhouse's Jay.

Not met with by our expedition. Recorded by Mr. Ridgway as abundant in cedar and piñon at 'City of Rocks,' in extreme southern Idaho, October 3, 1868 (Bull. Essex. Inst., vol. VII, No. 1, January, 1875, p. 24).

Perisoreus canadensis capitalis. Rocky Mountain Jay.

Tolerably common in the spruce and fir belt of the Salmon River Mountains, and also about the divide between Big Lost River and Trail Creek. Half a dozen were caught in marten traps in the Saw Tooth Mountains.

In July, 1872, I found this jay in numbers in Teton Cañon.

Corvus corax sinuatus. Raven.

Common along the lava cañon of Snake River, and seen occasionally on the Snake Plains and in Birch Creek Valley and the valleys of the Pahsimeroi and Salmon Rivers. Two were seen at Castle Rock, on the plains south of Snake River, and a number along the north base of the Brunneau and Elk Mountains near the boundary between Idaho and Nevada. A flock of about 40 Ravens was seen at Humboldt Wells, Nevada, October 17.

Mr. Ridgway found Ravens common at 'City of Rocks,' near the southern border of Idaho, October 3, 1868 (Bull. Essex. Inst., VII, 1875, p. 24).

Corvus americanus. Crow.

Common in Lemhi Valley, particularly at a point a few miles north of Junction, in August and early in September. A few were seen at Saw Tooth Lake the last week in September. Capt. Charles E. Bendire tells me that Crows breed commonly in the neighborhood of Fort Lapwai, Idaho.

Picicorvus columbianus. Clark's Nutcracker.

Common in the spruce belt on all the mountains visited. Several were caught in marten traps baited with meat. J. K. Townsend met with this species in the mountains near Bear River, in the southeastern corner of Idaho, in July, 1834. (Townsend's Narrative, 1839, p. 82.)

Cyanocephalus cyanocephalus. Piñon Jay.

Not found by our party. Mr. Ridgway records the Piñon Jay as abundant among cedar and piñon at 'City of Rocks' in extreme southern Idaho, October 3, 1868. (Bull. Essex Inst., vol. VII, No. 1, January 1875, p. 24.)

Dolichonyx oryzivorus albinucha. Western Bobolink,

One seen in an oat field in Lemhi Valley August 31. It was in fall plumage.

Molothrus ater. Cowbird.

A few seen on Big Lost River and Birch Creek, and one at Big Butte. Captain Bendire has found it breeding near the Palouse River in northwestern Idaho.

Xanthocephalus xanthocephalus. Yellow-headed Blackbird.

A few Yellow-headed Blackbirds were observed near the sinks of Big Lost River late in July, and again September 10—on the latter date in flocks of Brewer's Blackbird.

In 1872 I found it breeding in Marsh Valley in southeastern Idaho, and secured a nest containing four nearly fresh eggs June 29. The nest was in a clump of rushes 1½ meters (about 5 feet) above the water. It was composed of dry swamp grass without lining, and presented the same appearance inside as out. (Merriam, Hayden's Report for 1872, 1873, p. 686.)

Agelaius phœniceus. Red-winged Blackbird.

Two were seen by Mr. Bailey July 12 on Cedar Creek in the foothills of the Blackfoot Mountains, and a few late in July on Big Lost River, above Arco.

Sturnella neglecta. Western Meadowlark.

Common throughout the sage plains and valleys, remaining in considerable numbers until after snowfall in October. Usually heard singing in the early morning.

Icterus bullocki. Bullock's Oriole.

A pair seen on Snake River, near Blackfoot, about the middle of July, and many in the trees bordering Big Lost River, both above and below Arco, the latter part of the same month.

In 1872 I found Bullock's Oriole breeding abundantly along Devil Creek in southeastern Idaho. Captain Bendire records it as an abundant breeder at Fort Lapwai, where he has seen "as many as five occupied nests on a single small birch tree." (Proc. Bost. Soc. Nat. Hist., Vol. XIX, 1877, p. 122.)

Scolecophagus cyanocephalus. Brewer's Blackbird.

Abundant everywhere along the streams and about ranches and mining camps. Immense flocks, some containing fully a thousand birds, were seen in Lemhi Valley early in September.

Brewer's Blackbird takes the place of the English Sparrow in the West, where it is almost invariably found in barnyards and towns, picking crumbs in the streets and dooryards with the utmost familiarity.

Coccothraustes vespertina montana Ridgway. Evening Grosbeak.

Capt. Charles E. Bendire informs me that he found Evening Grosbeaks about the lakes at the headwaters of the Payette River, in the mountains of central Idaho, in July, 1877. He saw the old birds carrying food up into the tall pines.

Pinicola enucleator. Pine Grosbeak.

Breeds in the Salmon River Mountains and doubtless in most of the other high mountains of Idaho. An immature bird was shot and another seen near Timber Creek, in the Salmon River Mountains, the last week in August; and a red male was shot and six others seen September 5, near Eight-Mile Cañon, in the same range.

Carpodacus cassini. Cassin's Purple Finch.

One shot at timber line on the Salmon River Mountains August 29. It was in company with a small flock of Leucostictes. Others were seen near the same place.

Large flocks of a species of *Carpodacus* were seen feeding on seeds of wild sunflowers near the mouth of Little Lost River, September 10.

Leucosticte atrata. Black Leucosticte.

Common high up on the Salmon River Mountains. I shot two immature birds above timber line August 29, and saw several small flocks of young and adults at various times.

Spinus tristis. Goldfinch.

A few seen in July about the foothills of the Blackfoot Mountains. Common along Birch Creek about the middle of August.

In 1872 I found this species common at Fort Hall in October.

Spinus pinus. Pine Siskin.

A few were found in the Salmon River Mountains and at Saw Tooth Lake.

In 1872 I found Pine Siskins in numbers at First Cottonwood Creek, in Teton Basin, in July, and about Henry Lake early in August.

Rhynchophanes mccownii. McCown's Longspur.

An immature female was killed at the sink of Birch Creek August 6, by Mr. Bailey.

Passer domesticus. English Sparrow.

Mr. Clark P. Streator observed English Sparrows in the railroad town of Pocotello early in July. They undoubtedly followed the Utah Northern Railway from the valley of Great Salt Lake, where a large colony has been established for many years.

Poocætes gramineus confinis. Western Vesper Sparrow.

Common in the sage brush along Snake River, in Birch Creek and Lemhi Valleys, and in the Pahsimeroi Valley; seen also in the valley at the head of Salmon River, near Saw Tooth or Alturas Lake, about the end of September.

Ammodramus sandwichensis alaudinus. Western Savanna Sparrow.

Probably breeds in Birch Creek Valley, where three were killed August 4 and August 15. A few were seen in Lemhi Valley late in August and in early September.

In 1872 I saw a flock of these sparrows, and shot one, on a small gravel island in Snake River, October 8.

Chondestes grammacus strigatus. Western Lark Sparrow.

Not common anywhere. A few were observed near the mouth of Little Lost River during the latter part of July, and again September 10.

Zonotrichia leucophrys. White-crowned Sparrow.

Rather common in the Pahsimeroi Mountains the middle of September; adults in full plumage were killed.

Zonotrichia intermedia. Intermediate Sparrow.

Common during fall migration. Dozens were shot at Saw Tooth or Alturas Lake for marten bait the last week in September and first few days of October. Many were seen in the lava cañon of Snake River at Shoshone Falls, October 9–11.

In 1872 I killed a specimen at Fort Hall, October 13.

Spizella socialis arizonæ. Western Chipping Sparrow.

Tolerably common about the foothills of the Salmon River Mountains. Shot one at the head of Saw Tooth Lake, October 2; it was in a small flock of Juncos and Zonotrichias.

In 1872 this species was found on Conant Creek and at Fort Hall, in July.

Spizella breweri. Brewer's Sparrow.

Common in the sage brush along the Snake Plains, and in Birch Creek and Lemhi Valleys.

In 1872 I found a nest of Brewer's Sparrow in a sage brush on Conant Creek, Idaho, July 21. It contained three nearly fresh eggs.

Junco hyemalis shufeldti. Rocky Mountain Junco.

Common in the mountains during migration; several seen in the cañon of Snake River near Shoshone Falls, October 9–11.

Junco annectens. Pink-sided Junco.

Spotted young were killed high up in the Salmon River Mountains about the middle of August, and adults in fall plumage were found low down in the Salmon River and Saw Tooth Mountains later in the season.

Amphispiza belli nevadensis. Sage Sparrow.

Breeds abundantly throughout the sage plains and in the valleys of Birch Creek and Lemhi River, and Big and Little Lost Rivers. It was particularly numerous along Snake River in October.

Melospiza lincolni. Lincoln's Sparrow.

One shot at an altitude of 2,960 meters (9,700 feet) in the Pahsimeroi Mountains, September 16, and one caught in a small trap set for field mice (*Arvicola*) in marsh grass near the head of Saw Tooth Lake, September 28.

Melospiza fasciata montana. Mountain Song Sparrow.

Common on Cedar Creek in the foothills of the Blackfoot Mountains, and a few seen along Snake River about the middle of July. Common in the willows along the streams in Lemhi and Birch Creek Valleys in August and early September; several seen and one shot in the lava cañon of Snake River at Shoshone Falls, October 9–11.

In 1872 I found this Song Sparrow breeding along Henry Fork of Snake River, and secured several specimens at Fort Hall, October 12–14.

Pipilo chlorurus. Green-tailed Towhee.

Found in the mountains north of Arco and common in the cañons of the Lost River Mountains.

In 1872 I found it breeding on Conant Creek, Henry Fork of Snake River, and in Teton Basin.

Habia melanocephala. Black-headed Grosbeak.

A few pairs were found breeding in the willows along Snake River near Blackfoot, and on the lower part of Big Lost River.

In 1872 I found it breeding along First Cottonwood Creek in Teton Basin, and took a nest there containing two fresh eggs, July 22. Captain Bendire reports it as breeding at Fort Lapwai, Idaho (Proc. Bost. Soc. Nat. Hist., XIX, 1877, 121).

Passerina amœna. Lazuli Bunting.

Not observed by our party during the present season. In 1872 I found it common in the undergrowth bordering some of the streams in Teton Basin in July. Capt. Charles E. Bendire states that "in the vicinity of Fort Lapwai, Idaho, it is one of the most common species breeding there" (Proc. Bost. Soc. Nat. Hist., XIX, 1877, 121).

Calamospiza melanocorys. Lark Bunting.

Half a dozen were seen in the sage plains west of Blackfoot, July 17, and three between Big Butte and Big Lost River, July 21.

Piranga ludoviciana. Louisiana Tanager.

Two were seen in the Lost River Mountains the last week in July.

In 1872 I shot a male on Middle Fork of Snake River, August 4, and found the species common in Teton Cañon in July.

Petrochelidon lunifrons. Cliff Swallow.

Found breeding on the basaltic walls of the cañon of Blackfoot River about the middle of July. Also nests on the lava cliffs about 16 kilometers (10 miles) south of Nicholia, in Birch Creek Valley, and was observed at several other places before the middle of August.

In July, 1872, I found this species in numbers at Fort Hall, and secured a nest containing two fresh eggs on Ross Fork, July 3. The nest was made of mud, and was fastened to the bank of the stream 2½ meters (about 8 feet) above the water.

Chelidon erythrogaster. Barn Swallow.

Mr. Bailey saw one near the foot of the Blackfoot Mountains July 12, and found a pair breeding at the ranch at Big Butte. A few were seen nearly every day in August in Birch Creek and Lemhi Valleys. They breed at Scott's ranch, near Nicholia, and at the Lemhi Indian Agency.

During the early part of July, 1872, I found Barn Swallows in numbers at Fort Hall.

Tachycineta thalassina. Violet-green Swallow.

Abundant along Snake River and Big Lost River in July. Common in Birch Creek Valley until the middle of August; a few seen afterward.

Clivicola riparia. Bank Swallow.

Not noted by our party. In July, 1872, I found a colony of Bank Swallows breeding on Henry Fork of Snake River.

Ampelis garrulus. Bohemian Waxwing.

Mr. Dwight J. Kenney, of Fort Lemhi, Idaho, states that the Bohemian Waxwing is common in winter in Lemhi Valley, and reminded me of the circumstance that he sent me a specimen for identification several years ago, which fact I well remember.

Ampelis cedrorum. Cedar Waxwing.

Capt. Charles E. Bendire tells me that in 1871 he found the Cedar Waxwing breeding commonly about Fort Lapwai, Idaho, where he collected two of their nests June 19, and another June 26.

Lanius borealis. Northern Shrike.

The Great Northern Shrike was first seen October 16 near Mary River, in northern Nevada. Three individuals were observed on this day, and another near Humboldt Wells the day following. The latter was in pursuit of a small bird.

October 12, 1872, I shot a Shrike of this species at Fort Hall, the only one seen during the season.

Lanius ludovicianus excubitorides. White-rumped Shrike.

Rather common along Snake River, near Blackfoot, in July; a few seen near Big Butte, along Big Lost River, and at the actual sink of Birch Creek. Rare elsewhere. One seen near Eagle Rock, August 21; one in Little Lost River Valley September 11, and another in the Pahsimeroi Valley September 17.

October 13, 1872, I shot a White-rumped Shrike at Fort Hall.

Vireo gilvus swainsoni. Western Warbling Vireo.

Common in the Lost River Mountains the last week of July, at which time the young were just out of the nest. Two were killed near the lower edge of the Douglas fir zone in the Salmon River Mountains in August.

Vireo solitarius cassini. Cassin's Vireo.

Capt. Charles E. Bendire informs me that he found Cassin's Vireo breeding at Fort Lapwai, Idaho, in June, 1871.

Helminthophila celata. Orange-crowned Warbler.

Mr. Clark P. Streator killed one in the Salmon River Mountains, August 22, and I think I saw several others near the same place.

Dendroica æstiva. Yellow Warbler.

Common along Snake River near Blackfoot, and along Big Lost River in July; and in willows along Birch Creek and Lemhi River in August.

Dendroica auduboni. Audubon's Warbler.

Breeds abundantly throughout the Salmon River and Saw Tooth Mountains, coming down into the valleys in September. Two were seen in the cañon of Snake River near Shoshone Falls, October 9–11.

Geothlypis macgillivrayi. Macgillivray's Warbler.

Common and breeding in the Lost River Mountains in July; and common in Birch Creek Valley about the middle of August.

Geothlypis trichas occidentalis. Western Yellowthroat.

Captain Bendire informs me that the Western Yellowthroat breeds at Fort Lapwai, Idaho, where he took a nest with 4 eggs June 18, and one with 5 eggs June 23, 1871.

Icteria virens longicauda. Long-tailed Chat.

Common in cañon of Cedar Creek in the foothills of the Blackfoot Mountains about the middle of July, and called Mockingbird by the ranchmen (Bailey).

In 1872 I shot a male on Devil's Creek, June 28. Capt. Charles E. Bendire informs me that the Long-tailed Chat breeds commonly in the neighborhood of Fort Lapwai, Idaho.

Sylvania pusilla pileolata. Pileolated Warbler.

Abundant in the willows along Birch Creek and Lemhi Valley, and in the undergrowth in the mountains during the latter part of August.

Anthus pensilvanicus. Titlark; Pipit.

Breeds on the Salmon River Mountains and doubtless also on the other high mountains of Idaho. During the latter half of September and early October it was the most abundant species on the sage plains, on many days outnumbering all other species together.

Cinclus mexicanus. Dipper; Water Ouzel.

Found on many of the mountain streams in the Pahsimeroi and Saw Tooth Mountains, and seen also in the lava cañon of Snake River in October. Several were seen on Trail Creek and on Wood River—one within 1½ kilometers (about a mile) of the town of Ketchum. The species was not observed by our party in the Salmon River Mountains, though it was said to occur there and to winter along Birch Creek and the Lemhi River. It was common on the west Fork of the Pahsimeroi, where I found a beautiful nest in a niche in the face of a rock cliff at the side of a series of cascades. The nest was a sub globular mass of moss with the entrance fronting the stream, and could not be reached from any direction. While lunching on Trail Creek one day during the latter part of September, an Ouzel was observed wading and diving in the rapids. I dipped a cupful of water and tossed it in the air; as it fell splashing on the stream he immediately flew to the spot and seemed disappointed that the commotion was so soon over. At Saw Tooth Lake an Ouzel surprised us by running around the head of the lake on the sand beach.

Oroscoptes montanus. Sage Thrasher.

Common throughout the sage-covered plains and valleys. Killed as far north as Junction, in Lemhi Valley, and as late as September 7 in Birch Creek Valley.

Galeoscoptes carolinensis. Catbird.

A few were seen along Snake River near Blackfoot, and in Cedar Creek Cañon in the foothills of the Blackfoot Mountains, during the early part of July (and two specimens were preserved). One was seen on Big Lost River about 24 kilometers (15 miles) below Arco the latter part of July.

Salpinctes obsoletus. Rock Wren.

Common on the rocky summits of most of the mountains visited, and occurring lower down wherever suitable rocky places were found. Seen in Snake River Cañon in October.

Catherpes mexicanus conspersus. Cañon Wren.

Observed in the lava cañon of Snake River, near Shoshone Falls, early in October.

Troglodytes aëdon aztecus. Western House Wren.

A nest containing full grown young was found in the bridge over Snake River at Blackfoot about July 10. Specimens were obtained also on Big Lost River.

In July, 1872, I found this species common on Henry Fork of Snake River, and on Middle Fork, and found its nest in the latter locality July 20. "It was in the hollow of a small tree that had broken off about 3 meters (10 feet) high and still rested against its stump. The nest contained five young birds." (Merriam, Sixth Annual Report, Hayden Survey, 1873, 673–674.)

Troglodytes hiemalis. Winter Wren.

One seen in the Saw Tooth Mountains, October 1.

Cistothorus palustris. Long-billed Marsh Wren.

Common in a patch of cat-tails in the cañon of Snake River at Shoshone Falls early in October; not seen elsewhere.

October 14, 1872, I shot one of these wrens and saw several others in a small marsh near Fort Hall.

Certhia familaris montana. Rocky Mountain Creeper.

One shot and several others seen at Saw Tooth Lake.

Sitta carolinensis aculeata. Slender-billed Nuthatch.

One shot at Saw Tooth Lake, and a few seen in the Salmon River and Lost River Mountains.

Sitta canadensis. Red-breasted Nuthatch.

One shot and two others seen in the Salmon River Mountains near Junction.

Parus atricapillus septentrionalis. Long-tailed Chickadee.

Common among the willows bordering the small streams in Lemhi and Birch Creek Valleys. Captain Bendire tells me that this Chickadee breeds commonly about Fort Lapwai, Idaho.

Parus gambeli. Mountain Chickadee.

Abundant in the Salmon River and Saw Tooth Mountains.

Regulus satrapa. Golden-crowned Kinglet.

An adult male was shot and others seen in the Salmon River Mountains in August. Common among the willows along the lower part of the coniferous forest belt of the Salmon River Mountains in Lemhi and Birch Creek Valleys during the early part of September; and a few were seen in the Pahsimeroi Mountains the middle of September, and several in the Saw Tooth Mountains about the 1st of October.

Regulus calendula. Ruby-crowned Kinglet.

Common in the Pahsimeroi and Salmon River Mountains during fall migration. Probably breeds. A few were seen in the Saw Tooth Mountains about October 1, and a few in the cañon of Snake River, near Shoshone Falls, October 9 to 11.

Myadestes townsendii. Townsend's Solitaire.

Common in the Pahsimeroi Mountains September 12 to 16, where at least a dozen were seen in one day. One was seen in the lava cañon of Snake River near Shoshone Falls October 10.

Turdus ustulatus swainsonii. Olive-backed Thrush.

Not noted by our party. In 1872 I found a nest containing two fresh eggs of this species in Teton Basin, July 21.

Turdus aonalaschkæ auduboni. Audubon's Hermit Thrush.

Not found common anywhere. A few were seen in the spruce forests of the Salmon River Mountains in August, and one in the lava cañon of Snake River October 9.

Merula migratoria propinqua. Western Robin.

Tolerably common in July along Snake River, near Blackfoot, in the Lost River Mountains, and on Big Lost River. In August and September a few were seen from time to time in Lemhi and Birch Creek Valleys and in the upper part of Wood River Valley, but it was nowhere common. A flock remained for several days about the head of Saw Tooth or Alturas Lake the last week of September.

Sialia arctica. Mountain Bluebird.

Common along the lower edge of the Douglas fir zone and in scattered cottonwoods along the Salmon River, Lost River, Pahsimeroi, and Saw Tooth Mountains, and in the Lemhi and Birch Creek Valleys. A few were seen in the Snake River cañon at Shoshone Falls, October 9-11. Mr. Bailey saw a flock of 10 at Big Butte about the middle of July, and a few along Big Lost River the latter part of the month. Young were seen with their parents in Birch Creek Valley August 6.

ANNOTATED LIST OF REPTILES AND BATRACHIANS COLLECTED BY DR. C. HART MERRIAM AND PARTY IN IDAHO, 1890.

By LEONHARD STEJNEGER.

A.—REPTILIA.

Sceloporus graciosus B. & G.

Two typical males from Blackfoot and Big Lost River and one identical with these in every respect from the Lemhi Indian Agency were collected.

This species, easily recognizable by its slender form and the smallness of its scales, is characteristic of the region in question.

The material at hand is not sufficient to settle beyond a doubt the question whether *S. graciosus* and *gracilis* are absolutely identical.

The specimens collected are all males. In No. 310 there is hardly a trace of blue on the throat, while in No. 314 the whole under side of the head is evenly marbled with pale blue; No. 328 is intermediate both in the extent and in the intensity of the blue color.

List of specimens.

U. S. National Museum No.	Collector and No.	Sex.	Locality.	Date.	Total length.	Length of head.	Length of tail.	Scales in head length.	Remarks.
16768	B. & D., 310	♂	Blackfoot, Idaho	July 16, 1890	130	11	76	13	
16769	D., 314	♂	Big Lost River, Idaho	July 21, 1890	122	11	74	13	
16770	B. & D., 328	♂	Lemhi Indian Agency, Idaho.	Sept. 3, 1890	102	10	66	13	"5,400 feet."

Phrynosoma douglasii (Bell).

As might be expected, the Horned-toads belong to the typical form, that is, the northwestern race which has been called *Ph. pygmæa* (see N. Am. Fauna, No. 3, p. 112). The larger of these specimens collected are no pigmies, as the dimensions below show, although not reaching the size of *Ph. ornatissimum*, their nearest ally. They are all of the characteristic gray pepper-and-salt color usually found in the typical form.

List of specimens.

U. S. National Museum No.	Collector and No.	Sex.	Locality.	Date.	Total length.	Length of head.	Length of tail.	Width of head.	Remarks.
16771	B. & D., 309	♀	Blackfoot, Idaho	July 13, 1890	97	17	29	19	On black lava sand.
16772	B. & D., 312	♀	Big Butte, Idaho	July 19, 1890	96	17	30	20	On black lava rock.
16773	B. & D., 313	♀	....do	....do	72	14	20	16	On sand in valley.
16774	B. & D., 319	♀	Big Lost River, Idaho	July 21, 1890	71	14	23	16	On sand.
16775	B. & D., 320	♀	....do	... do	73	15	22	17	On lava rock.

Pituophis catenifer (Blainv.).

The two Bull-snakes collected are provisionally enumerated under the above name, as the status of the various forms has not yet been definitely settled. Unfortunately, our large series of these snakes is inaccessible to me at the present writing. I can, therefore, only remark that these two specimens have a remarkably short cranium and that the dorsal blotches average 55 in front of the anus; all the scale keels of the light spaces are blackish. (U. S. Nat. Mus. No. 16776; Bailey and Dutcher, No. 316, Big Butte, Idaho, July 18, 1890; No. 16777; Bailey, No. 315 Arco, Idaho, July 25, 1890.)

Bascanion vetustus B. & G.

A single specimen was collected at Big Butte, Idaho, July 19, 1890. Seven upper labials, fourth and fifth in contact with lower postorbital. (U. S. Nat. Mus. No. 16778; B. & D. No. 318.)

Eutainia vagrans B. & G.

The seven Garter-snakes collected all belong to this widely distributed species and are comparatively uniform both in scale formula and coloration. Nos. 322 and 325 have a somewhat darker ground color above, but No. 334 is scarcely lighter and has, moreover, the whole upper surface of the head nearly black.

List of specimens.

U. S. National Museum No.	Collector and No.	Locality.	Date.	Scale rows.	Supra labials.	Remarks.
16779	M. & B., 322	Salmon River Mountains, Idaho	Aug. 20, 1890	21	8	"8,000 feet."
16780	M. & B., 325	....do	Aug. 22, 1890	21	8	Do.
16781	B. & D., 321	Birch Creek, Idaho	Aug. 4, 1890	21	7-8	
16782	B. & D., 329	....do	Sept. 8, 1890	21	8	"5, 800 feet."
16783	B. & D., 333	Challis Valley, Idaho	Sept. 18, 1890	21	8	"5,300 feet, caught in brook."
16784	B. & D., 332	.. do	Sept. 20, 1890	21	8	
16785	B. & D., 334	Trail Creek, Idaho	Sept. 22, 1890	21	8	

Crotalus lucifer B. & G.

This Rattlesnake, which is characteristic of northern California and Nevada, Oregon and Washington, is represented by four specimens obtained in the desert, two at Big Butte and two at Little Lost River.

These specimens are in every way typical and can not be mistaken for the following species, of which a specimen was secured at Lemhi Indian Agency, the more rounded outline of the head and the numerous granules between and adjoining the superciliary scales being quite characteristic.

The specimens are all young, except No. 311, which has quite a respectable size for this species, the head being about 40^{mm} long (only head and forepart of body preserved).

List of specimens.

U. S. National Museum No.	Collector and No.	Locality.	Date.	Remarks.
16786	B. & D., 311, 338..	Big Butte, Idaho......................	July 19, 1890	Anterior half and rattle only.
16787	B. & D., 317......	....do	July 18, 1890	
16788	B. & D., 330......	Little Lost River, Idaho	Sept. 9, 1890	
16789	B. & D., 331......	Little Lost River (mouth of), Idaho..	....do	

Crotalus confluentus Say.

The occurrence of a typical example of this species in Idaho is highly interesting, and it is quite suggestive that it was obtained in Lemhi Valley near the Indian agency, between which locality and Montana, where *C. confluentus* is the characteristic species, there is only a low divide, as Dr. Merriam informs me, over which the range of the species may be continuous, while to the south there is a divide separating it from the range of *C. confluentus*.

The present specimen belongs to the typical group of the species, the original of which came from the plains of northeastern Colorado near the Arkansas River. I have compared numerous specimens from Montana and Nebraska, as well as the Idaho specimen here referred to, with individuals from the type locality and find them to be in every way identical, and entitled to the name bestowed upon the species by Say. (U. S. Nat. Mus. No. 16791; Bailey and Dutcher coll., No. 327; Lemhi Indian Agency, Idaho, 5,400 feet altitude; September 3, 1890.)

B.—BATRACHIA.

? ? **Ambystoma**[*] epixanthum Cope.

I refer a young specimen (No. 337) collected by Dr. Merriam and Mr. Bailey a little above Saw Tooth Lake on October 1 to this species with considerable hesitation, as I have had no opportunity to examine the unique type specimen. It differs considerably both in coloration and proportions, but these differences may possibly be attributable to the youth of the specimen, or to individual variation. The vomero-palatine teeth can not be made out clearly, but they seem to form one uninterrupted series on each side with the anterior ends well forward, in fact, anterior to the line through the choanæ, or exactly as in the figure of *A. epixanthum* (Cope, Batr. N. Am., p. 98). The head is comparatively broader than in *A. macrodactylum*, and so is the interorbital space, both characters which, according to Cope, separate *A. macrodactylum* and *epixanthum*.

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[*] The generic name should be written as above, not *Amblystoma*. The latter is a late and very doubtful emendation by Agassiz; and Amblystomus as the name of a

The tongue of the present specimen is remarkably small, a feature which has caused me more doubt than any other and which has tempted me to describe it as a new species, as Professor Cope in the diagnosis of his *A. epixanthum* expressly says "tongue large." But if the figure which he presents (op. cit., p. 98) is only approximately correct, the tongue of the latter species is certainly much smaller than in *A. macrodactylum*, which is correctly figured on page 96.

From the measurements given below it will be seen that the tail is considerably shorter in the present specimen than in either *A. macrodactylum* or *epixanthum*, but by measuring a full-grown and a smaller *A. macrodactylum* I find that the latter has the tail shorter in about the same proportions as between Cope's measurements and my own.

The color of the present species is dull and apparently more like *A. macrodactylum*, but it remains yet to be seen how constant and diagnostic is the bright coloring attributed to *A. epixanthum*.

It may not be out of place to remark that the type of the latter species was collected on the south side of the Saw Tooth Mountains, and the present specimen on the northern slope of the same mountains.

The dimensions in millimeters are as follows: Total length, 52; length to axilla, 14; to groin, 30; to gular fold, 10; width of head, 7; of tongue, 3; length of anterior limb, 11; of anterior foot, 3.5; of posterior limb, 12; of posterior foot, 4.5. (U. S. Nat. Mus. No. 16792.)

Rana pretiosa B. & G.

Five specimens from Saw Tooth Lake, the Lemhi Indian Agency, and the Salmon River Mountains. The specimens are typical and the localities within the known range of the species.

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coleopterous insect, moreover, antedates *Ambystoma*, which invalidates the use of the emended form according to the A. O. U. code of nomenclature. In Tschudi's original paper, which was edited by Agassiz, *Ambystoma* occurs four times, but it was not until several years later that the latter offered the amended spelling (cautiously adding a "?," however), as there is apparently no good derivation of Tschudi's word. But in this respect it is no worse than many other generic names both of ancient and modern times.

List of specimens.

U. S. National Museum No.	Collector and No.	Locality.	Altitude.	Date.
16793	Merriam & Bailey, 323.	Salmon River Mountains, Idaho.............	8,000 ft.	Aug. 20, 1890
16794	Bailey & Dutcher, 324..	....do....................................	....	Do.
16795	Bailey & Dutcher, 326..	Lemhi Indian Agency, Idaho..............	5,400 ft.	Sept. 3, 1890
16796	Bailey & Dutcher, 335..	Saw Tooth Lake, Idaho.....................	7,200 ft.	Sept. 28, 1890
16797	Bailey & Dutcher, 336..	....do....................................	....	Do.

DESCRIPTION OF A NEW GENUS AND SPECIES OF DWARF KANGAROO RAT FROM NEVADA (MICRODIPODOPS MEGACEPHALUS).

By Dr. C. HART MERRIAM.

One of the most remarkable of the many new and interesting mammals that have been discovered in North America during the past few years is the subject of the present article. In external appearance it looks like a heavy, thickset pocket mouse of the *Perognathus olivaceus* type, with a hydrocephalic head and abnormally large, furry hind feet. Its skull, on the other hand, does not suggest *Perognathus* at all, but resembles the skull of *Dipodops*, and has the tympanic and mastoid regions inflated to a degree surpassing even the extreme condition presented by *Dipodomys deserti*, which species exhibits the maximum of inflation heretofore known among mammals. It lacks the large cylindrical, crested-penicillate, four-striped tail of *Dipodomys* and *Dipodops*. In short, *Microdipodops* may be described as a *Perognathus* of the *olivaceus* type, with the skull of a *Dipodops;* but it is not simply intermediate between these two genera, for the skull surpasses that of *Dipodops* in the chief peculiarity by which the latter differs from *Perognathus.*

Six specimens of this remarkable rodent were collected in Nevada by Mr. Bailey in October and November, 1890. The precise localities are Halleck and Reese River.

MICRODIPODOPS gen. nov.

Similar to *Dipodops*, but with tympano-mastoid inflation carried to a still greater extreme. Shelf of palate produced posteriorly to foramen ovale, as in *Perognathus*, instead of ending at plane of last molars with a deep fossa on each side, as in *Dipodomys* and *Dipodops.* Lateral borders of parietals excavated to receive the deeply notched squamosals, each of which appears on the upper surface of the skull in the form of a narrow strip of bone bent in the shape of a V. Zygomatic process of maxillary as in *Perognathus*—not expanded in front of orbit as in *Dipodomys* and *Dipodops.*

The mandible lacks the post-molar pit of *Dipodomys* and *Dipodops;* the angular process is truncated and thickened instead of ending in a sharp point, and is much shorter than in *Perognathus*, *Dipodomys*, or *Dipodops*.

The enormously inflated mastoids nearly meet along the median line, leaving a narrow spicule of bone between them, and project posteriorly much further than in *Dipodomys* or *Dipodops*. The length of the tympano-mastoid inflation in the type specimen is more than 80 per cent. of the basilar length of the skull, and the breadth across the inflated mastoids is much greater than the basilar length (115 per cent.). This great development of the mastoids takes place at the expense of the supraoccipital, interparietal, and parietals, which are very much reduced.

Viewed from below, the audital bullæ meet in a symphysis, and the tympanic capsules project anteriorly far beyond the plane of this symphysis and beyond the plane of the fronto-parietal suture, extending along the outer side of the malar bone half way to the end of the zygomatic process of the maxillary. The molars are rootless, as in *Dipodomys* and *Dipodops*. The upper premolar has an anterior prism, as in *Perognathus*. The tail is simple, as in *Perognathus;* not greatly elongated, as in *Dipodomys* and *Dipodops*, and lacks the four longitudinal stripes always present in the latter genera. There is no trace of the conspicuous white band which crosses the thighs to the base of the tail in every species of *Dipodomys* and *Dipodops*.

MICRODIPODOPS MEGACEPHALUS gen. et sp. nov.

Type No. $\frac{24448}{31523}$. ♂. ad. U. S. National Museum (Department of Agriculture collection). From Halleck, Nevada, October 23, 1890. Collected by Vernon Bailey. (Original number, 2005.)

Measurements (from dry skin).—Total length, about 150; tail vertebræ, about 80; hind foot, 24; ear from crown, 6; from anterior base, 9.

General characters.—Size very much smaller than the smallest known species of *Dipodomys* or *Dipodops*, and only a trifle larger than *Perognathus olivaceus*. Tail not crested-penicillate as in *Dipodomys*, *Dipodops*, and *Chætodipus*, but simple, as in *Perognathus* proper. The tail is bicolor, as in *Perognathus*, lacking the four stripes of *Dipodomys* and *Dipodops*. Its length only slightly exceeds that of the head and body. The ears are completely covered with soft fur. The hind feet are long and densely furred on both sides to the very tips of the toes. The hallux without the claw reaches the metatarso-phalangeal articulation of the other toes. The fur of the back and sides is long, soft, and silky, as in *Hesperomys eremicus*.

Color.—Upper parts yellowish brown or clay color, finely mixed with black-tipped hairs and slightly tinged with olive; sides from nose to thighs suffused with pale ochraceous. Under parts white; the fur plumbeous at base and washed with pale ochraceous, except on throat and breast, which are white throughout. Feet soiled white, tinged with buffy. Tail bicolor; upper part like back, except terminal third, which is blackish; under side pale buffy ochraceous. There is a blackish crescent on each side of the face at base of whiskers, and a buffy patch behind each ear involving the lower base of the ear.

Cranial characters.—The cranial and dental characters have been given so fully in the description of the genus that it is unnecessary to repeat them here. The skull is much arched, both antero-posteriorly and laterally. The basioccipital is wedge-shaped, and is not cut away or emarginate on the sides.

DESCRIPTION OF A NEW EVOTOMYS FROM THE BLACK HILLS OF SOUTH DAKOTA.

By Dr. C. HART MERRIAM.

Two specimens of a Red-backed Mouse were collected in the Black Hills, South Dakota, in July, 1888, by Vernon Bailey. One was caught under a log in a thicket; the other by a log in the pine timber on top of the mountain. Both are adult males and differ from *E. gapperi* in having much shorter tails (in this respect resembling *E. dawsoni*[*] from the sources of the Liard River, N. W. T.), and in other particulars pointed out below.

EVOTOMYS GAPPERI BREVICAUDUS subsp. nov.

Type No. $\frac{4807}{5742}$ ♂ ad. Merriam Collection. From Custer, Black Hills, South Dakota, July 21, 1888. Collected by Vernon Bailey. (Original number 111.)

Measurements (taken in flesh).—Total length, 125; tail vertebræ, 31; hairs, 4; hind foot, 19. Ear from crown, 8.5; from notch, 10.5 (in dry skin). Another specimen taken at the same locality July 18, 1888 (No. $\frac{4806}{5741}$ ♂ ad.), measures: Total length, 130; tail vertebræ, 32; hairs, 3; hind foot, 20. Ear from crown, 9; from notch, 12.

General characters.—Similar to *E. gapperi*, but with larger ears and shorter tail. The hazel of the dorsal area is not so bright as in *gapperi;* the sides are the same golden brown.

Color.—Dorsal area dull hazel, lined with black-tipped hairs; rest of upper parts pale bister strongly suffused with ochraceous buff on the sides; face between the eyes and nose heavily lined with black-tipped hairs; under parts white, the plumbeous basal part of the fur hardly showing through; tail bicolor, above like the back except the tip, which is dusky; below gray.

Cranial and Dental characters.—Much as in *E. gapperi.*

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[*] *Evotomys dawsoni* Merriam, Am. Nat., July, 1888, 649–651.

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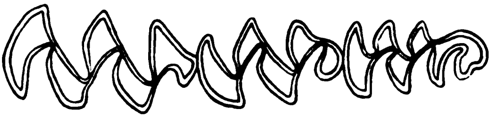
PLATE II.

(All magnified about 10 diameters.)

1, 2. *Arvicola riparius* Ord, ♂ ad. (No. $\frac{30535}{23575}$). Birch Creek, Idaho.
    1. Upper molar series.
    2. Lower molar series.
3, 4. *Arvicola mordax* sp. nov. ♂ ad. (No. $\frac{31233}{24231}$). Saw Tooth Mountains, Idaho. T
    3. Upper molar series.
    4. Lower molar series.
5, 6. *Arvicola nanus* sp. nov. ♀ ad. (No. $\frac{31253}{25853}$). Pahsimeroi Mountains, Idaho. T
    5. Upper molar series.
    6. Lower molar series.
7, 8. *Arvicola macropus* sp. nov. ♀ ad. (No. $\frac{31271}{25887}$). Pahsimeroi Mountains, Id
    Type.
    7. Upper molar series.
    8. Lower molar series.



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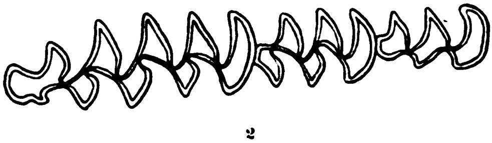

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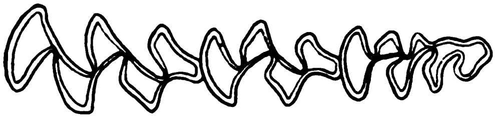

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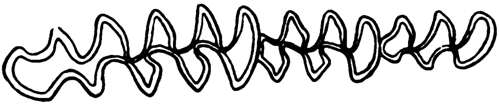

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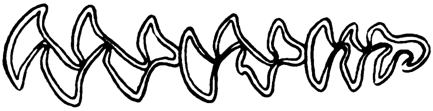

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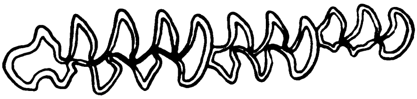

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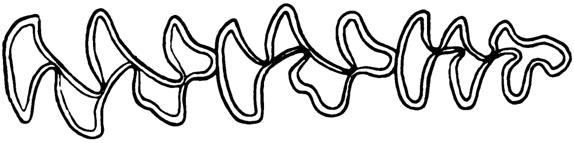

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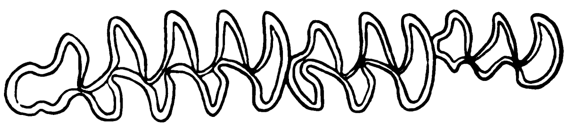


8

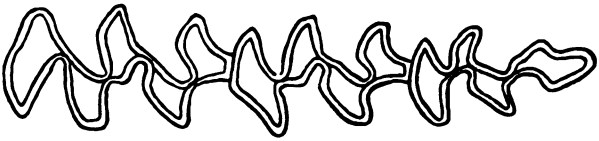
1, 2. *Arvicola riparius* Ord.
3, 4. *A. mordax* sp. nov.

5, 6. **A. nanus sp. nov.**
7, 8. **A. macropus sp. nov.**

PLATE III.

(All magnified about 15 diameters.)

1, 2. *Arvicola pauperrimus* Cooper, ♀ ad. (No. [illegible]). Salmon River Mountains, Idaho.
    1. Upper molar series.
    2. Lower molar series.
3, 4. *Phenacomys orophilus* sp. nov. ♀ ad. (No. [illegible]). Salmon River Mountains, Idaho. Type.
    3. Upper molar series.
    4. Lower molar series.
5, 6. *Evotomys idahoensis* sp. nov. ♀ ad. (No. [illegible]). Saw Tooth Mountains, Idaho. Type.
    5. Upper molar series.
    6. Lower molar series.
7, 8. *Evotomys brevicaudus* sp. nov. ♂ ad. (No. [illegible]). Black Hills, Dakota. Type.
    7. Upper molar series.
    8. Lower molar series.



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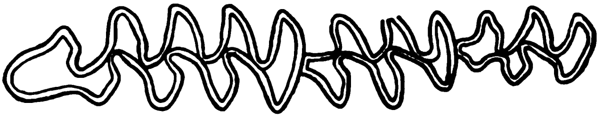

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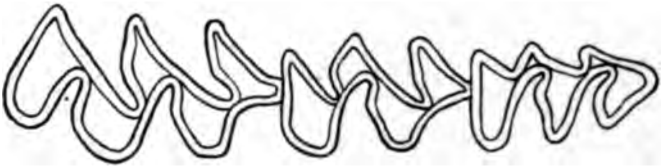

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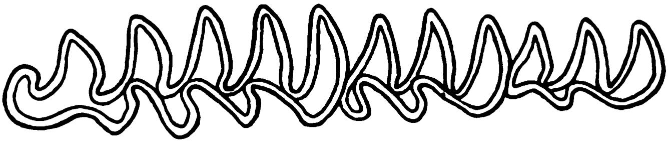

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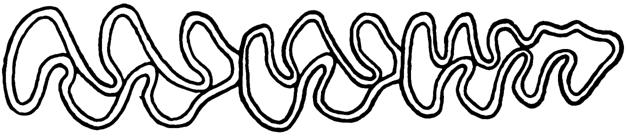

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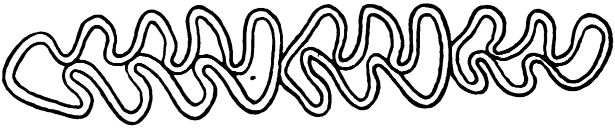

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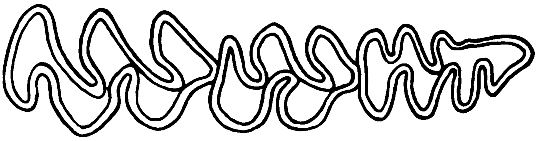

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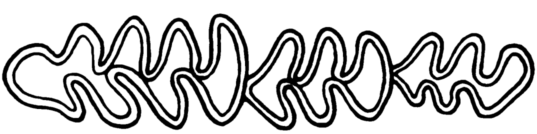


8

1, 2. *Arvicola pauperrimus* Cooper.
3, 4. *Phenacomys orophilus* sp. nov.

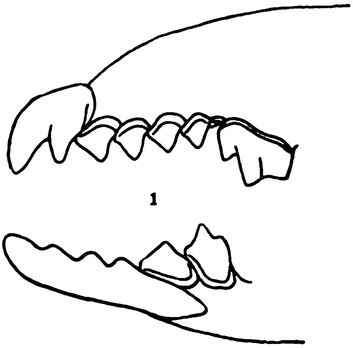
5, 6. *Evotomys idahoensis* sp. nov.
7, 8. Evotomys brevicaudus sp. nov.

PLATE IV.

(All magnified about 10 diameters.)

1. *Sorex idahoensis* sp. nov. ♀ ad. (No. $\frac{30945}{23327}$). Type. Salmon River Mountains, Idaho.
2. *Sorex dobsoni* sp. nov. ♀ (No. $\frac{31578}{24274}$). Type. Saw Tooth Mountains, Idaho.
3. *Sorex vagrans similis* subsp. nov. ♀ ad. (No. $\frac{30943}{23325}$). Type. Salmon River Mountains, Idaho.

PLATE IV.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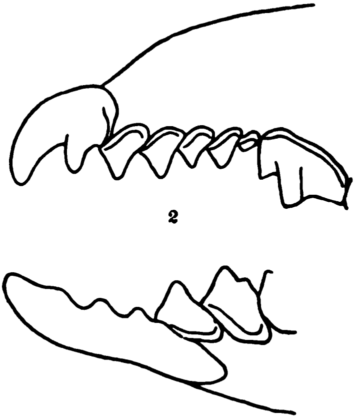
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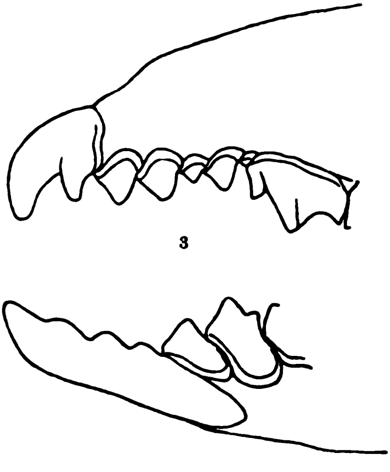
3

1. *Sorex idahoensis* sp. nov. 2. *S. dobsoni* sp. nov.
3. *S. vagrans similis* subsp. nov.

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